From Operational Pilot insights to SUMEPs – why and how do we need more integration of Mobility, Energy and Grid Planning?

Richard Kotter – University of Northumbria, Newcastle, UK

For: *Wissenschaftsforum Mobilität*, 20th Nov 2020

SEEV4-City Project Aims, Operational Pilots, and business models

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- **Three goals – investigated through 6 Operational Pilots in 4 countries, plus systematic analysis – jointly with POLIS and AVERE:**

(1) An increase in **electrical *energy autonomy*** (***Self-Consumption*** *of locally generated Renewable Energy (RES) – behind the meter, not necessarily Self-Sufficiency)*

(2) An increase of ***ultra-low emission kilometres (CO_2 reductions).***

(3) Avoiding extra investments to *make existing electrical grids compatible* with an **significant increase in electro-mobility** and **distributed / local renewable energy production**.

- **The results should enable:**
- **Clean electric transport services** and a **better use of renewable energy generation**;
- ***New business models/businesses*** **for** renewable energy & **ultra-low emission mobility services**;
- ***Social acceptance*** *studies,* ***management guidelines and policy frameworks.***

Do we need to consider the cost of EV (ESS) ownership/usage to developed feasible business models? Yes Is that all? NO

SEEV4-City Operational Pilots – Analysis (incl. Simulation and Modelling), Context, Feedback and Improvements, Transnationality and Scale-up of Vehicle for Energy Services, and integration into Sustainable Urban Energy and Mobility Planning https://www.seev4-city.eu/

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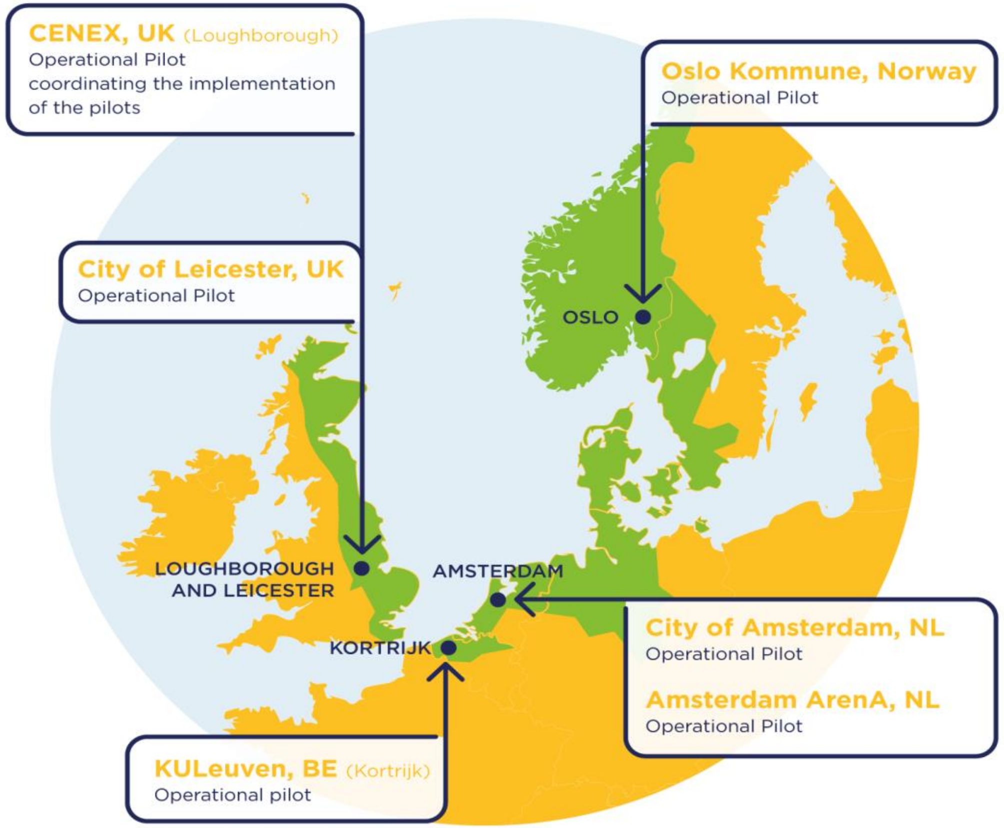
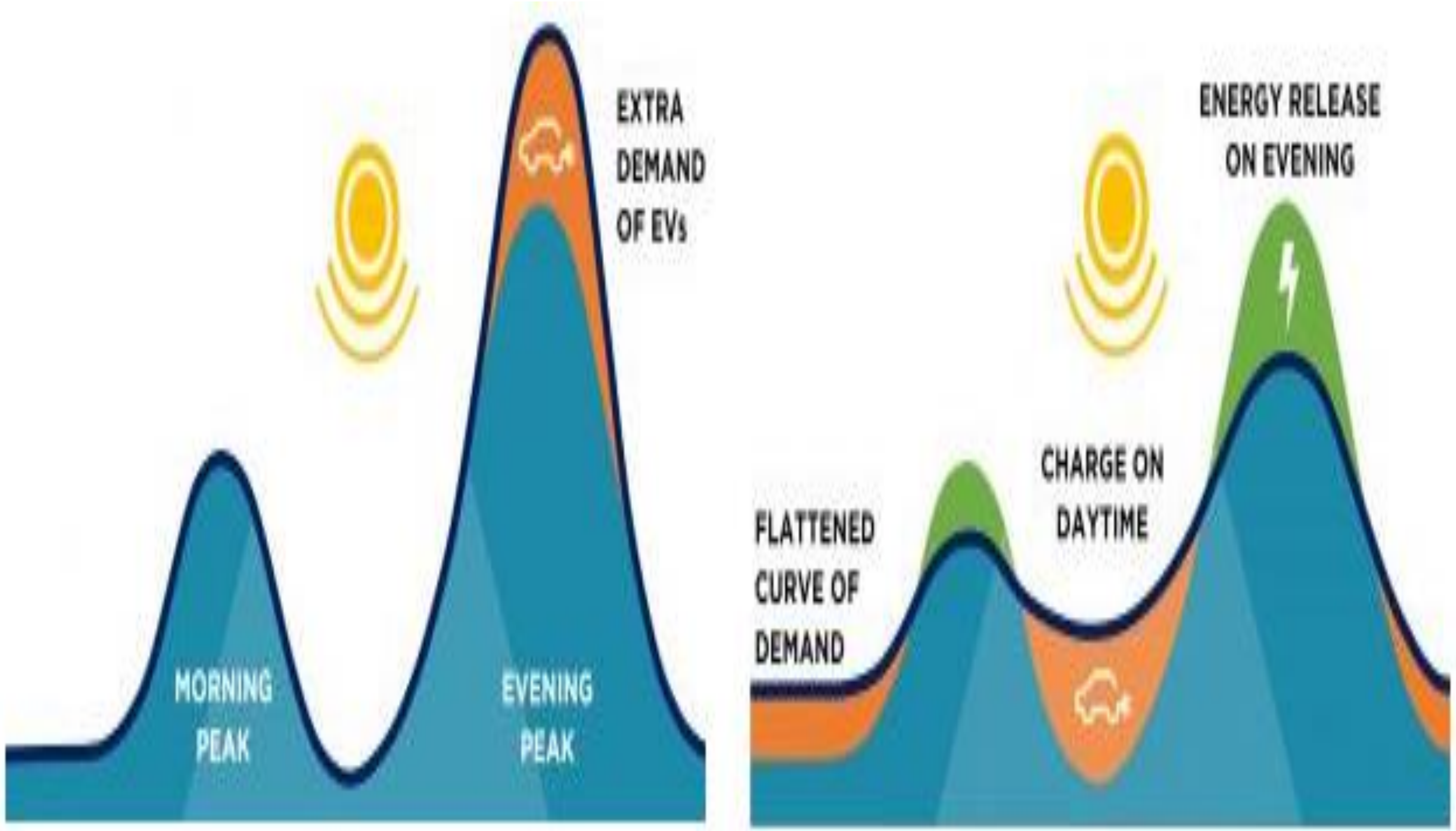
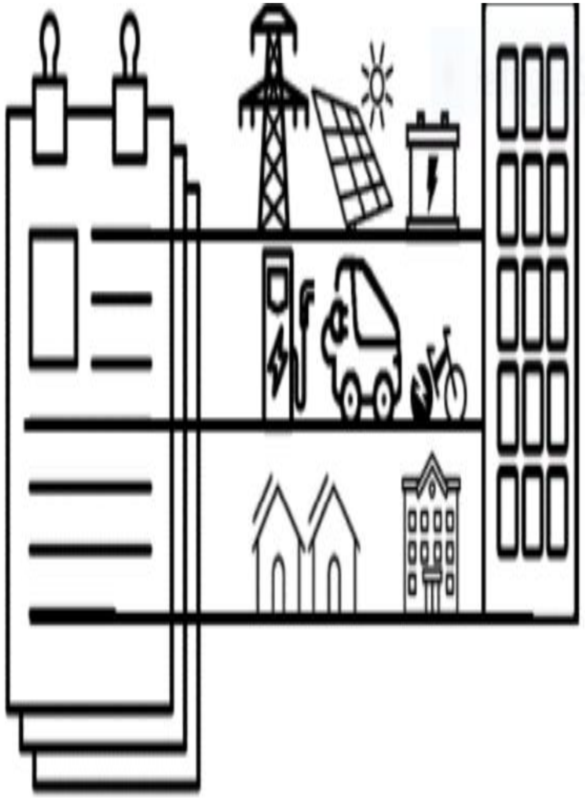
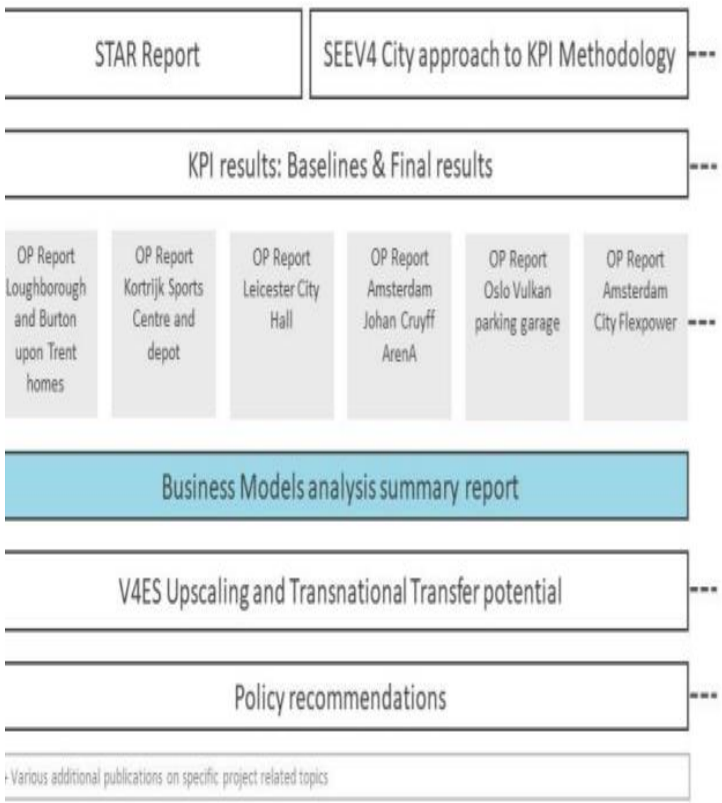




Uncontrolled versus Controlled/Smart Charging / Vehicle to Grid





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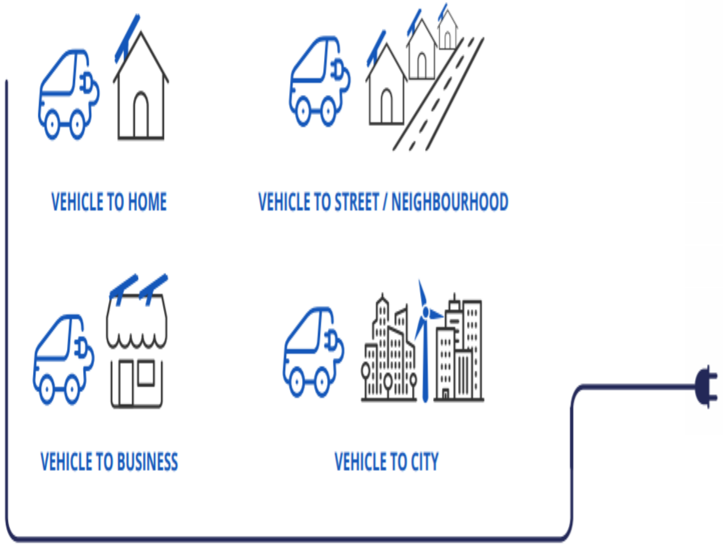

All end reports now available at:
https://www.seev4-city.eu/publications/

Communication and framing is very important

https://ieeexplore.ieee.org/document/8541956;

https://www.seev4-city.eu/wp-content/uploads/2020/06/Final-report-Behaviour-research-Flexpower.pdf

Dissemination of the benefits of Smart Charging and V2G to relevant stakeholders.

- It is important to **organise communication efforts to frame and explain the relative merits of smart charging and V2G vis-à-vis uncontrolled or "dumb-charging" to a broad spectrum of stakeholders**.
- This could be combined with the carbon emission savings portals and presented in a Dashboard similar to that of a smart meter, or like the MyGridGB smart home's Dashboard (http://www.mygridgb.co.uk/dashboard/) which provides a quick overview of the **live electricity mix, carbon emissions and the amount of low carbon electricity generated** in the UK.
- The MyGridGB dashboard and site both displays live electricity data for the UK (including with a Twitter feed) by generation source of low carbon electricity as well as carbon intensity by generation type, but also trends in electricity supply and demand over time (both annual and monthly: http://www.mygridgb.co.uk/last-12-months /).

State-of-the-Art Assessment of Smart Charging and Vehicle 2 Grid services (STAR report)

https://www.seev4-city.eu/wp-content/uploads/2020/08/Summary-of-State-of-the-Art-Assessment-of-Smart-Charging-and-V2G-services.pdf; https://www.seev4-city.eu/wp-content/uploads/2020/08/State-of-the-Art-Assessment-of-Smart-Charging-and-V2G-services.pdf

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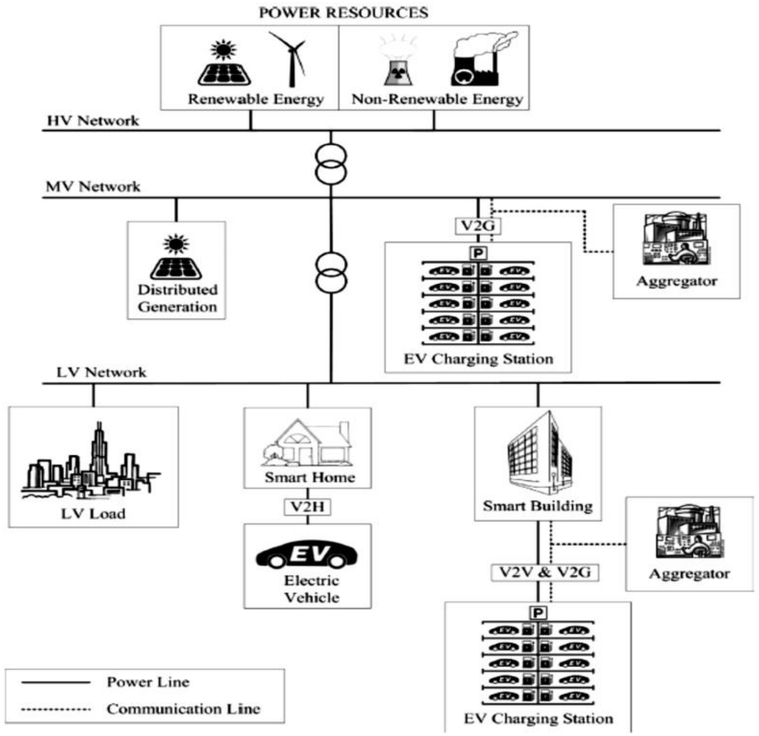

Power flow	Uni-directional (V1G)	Bi-directional
Infrastructure/ hardware	EV battery, communication system	EV battery and bi-directional battery charger, Communication system
Power levels	Level 1, 2 and 3	Level 1 and 2
Services	Spinning Reserve, power gird Power Regulation	Active Power Support, Spinning Reserve, Reactive Power Support, Power Factor Correction, improve power system stability, Harmonic Filter, Frequency Regulation Energy backup
Cost	Low	Expensive
Advantages/ benefits	Prevent overloading of power grid, minimise emissions and maximise revenue	Further improved grid stability and load profile, maintain voltage levels, reduce renewable energy intermittency, prevent power grid overloading, failure recovery, minimise emissions and maximise revenue
Disadvantages	Limited services	Battery degradation [depends on done how], investment cost, complex setup, and social/ behavioural barriers

Synergies to be aimed at through SEEV4-City – at different scales

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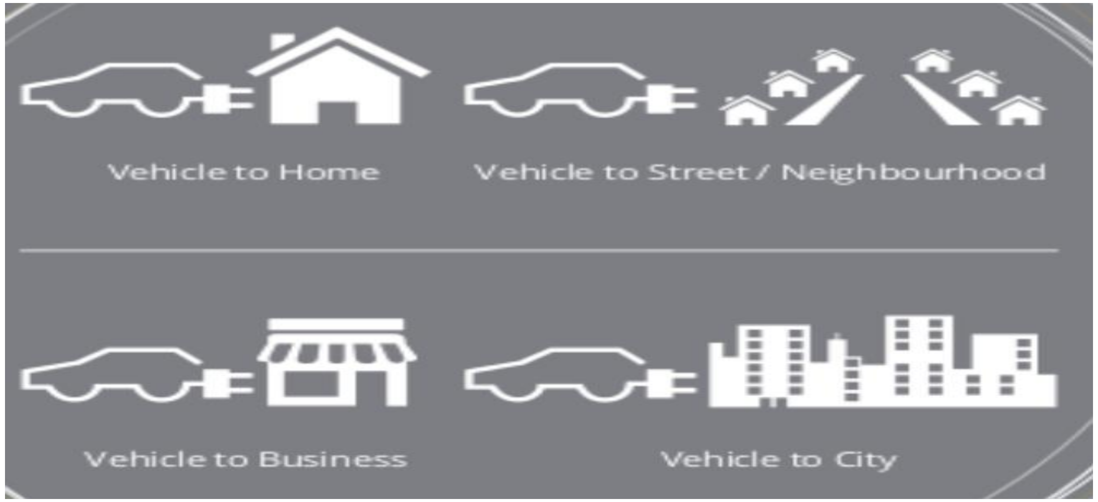
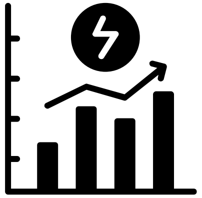
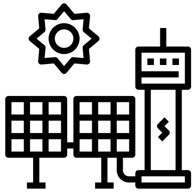
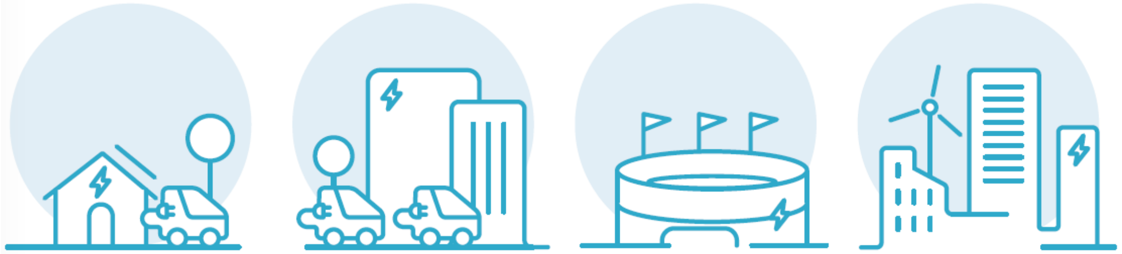






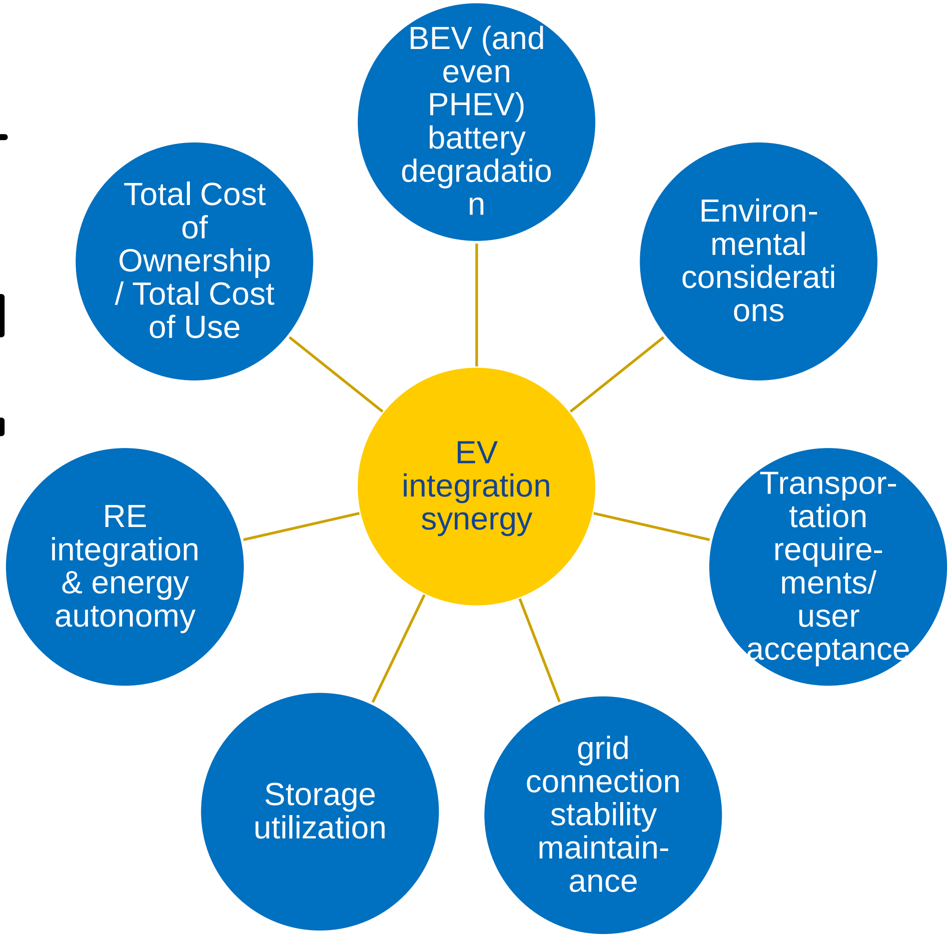


A single household with solar energy, storage and an electric vehicle;

Buildings with multiple electric vehicles and larger renewables;

Up to a large 'powerparking', a soccer stadium acting as 'energy hub' and

Large scale smart charging in public charging solutions in the city.



https://www.sciencedirect.com/science/article/pii/S096014812031569X

https://www.sciencedirect.com/science/article/abs/pii/S0360544220309336

Vehicle to Home

Vehicle to Business

Vehicle to Neighbourhood

Vehicle to City

Scale

Loughborough/Burton-upon-Trent Cenex employee x 2 **(UK)**

Kortrijk **(BE)**

Municipal Depot and Sports Complex

Leicester **(UK)**

Leicester City Hall

Amsterdam **(NL)**

Johan Cruyff Arena / Amsterdam Energy ArenA

Oslo **(NO)**

Vulkan Estate Car Parking Garage

Amsterdam **(NL)**

FlexPower 1 and 2 across Amsterdam public charging stations

https://www.seev4-city.eu/wp-content/uploads/2019/11/Vehicle2Grid-and-Smart-Charging-Learning-from-6-pilot-cases-Robert-van-den-Hoed-Polis-2019-Conference.pdf

SEEV4-City project building blocks schematic – system design components

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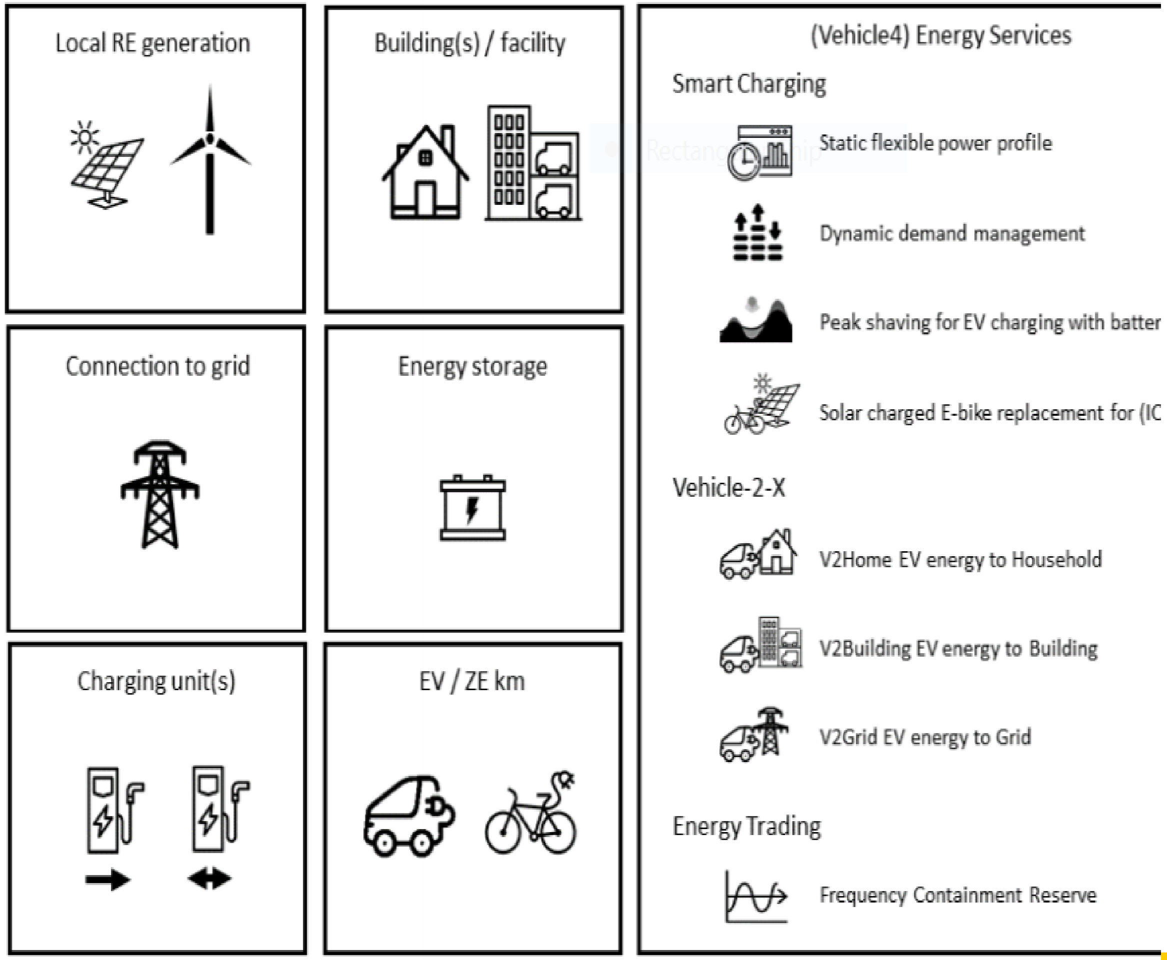

Characteristics of uni-directional (G2V, or V1G) and bi-directional (V2G) set-ups

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Power flow	Uni-directional (grid to EV, or V1G)	Bi-directional (V2G)
Infrastructure/ hardware	EV battery, communication system	EV battery and bi-directional battery charger, Communication system
Power levels	Level 1, 2 and 3	Level 1 and 2
Services	Spinning reserve, power gird power regulation	Active power support, spinning reserve, Reactive power support, Power factor correction, Improve power system stability, Harmonic filter, Frequency regulation Energy backup
Cost	(Comparatively) Low	(At least currently still) Expensive
Advantages/benefits	Prevent overloading of power grid, minimise emissions and maximise revenue	Further improved grid stability and load profile, maintain voltage levels, reduce renewable energy intermittency, prevent power grid overloading, failure recovery, minimise emissions and maximise revenue
Disadvantages	Limited services	Battery degradation, investment cost, complex setup, and social barriers

The SEEV4-City (Summary and Full) State-of-the-Art reports concluded:

https://www.seev4-city.eu/wp-content/uploads/2020/08/Summary-of-State-of-the-Art-Assessment-of-Smart-Charging-and-V2G-services.pdf

https://www.seev4-city.eu/wp-content/uploads/2020/08/State-of-the-Art-Assessment-of-Smart-Charging-and-V2G-services.pdf

- There are **three concepts of grid-connected EV technologies**: **V2V (Vehicle to Vehicle; Vehicle to Home (V2H) / Vehicle to Building(V2B) and Vehicle to Grid (V2G)**
- To a degree, Smart Charging (SC) and V2G technology has not yet matured; the biggest disadvantages include battery degradation and social barriers;
- **V2G becomes complex as large number of EVs (non-linear variables) are integrated into the power grid (grid constrains and limitations).** This is at least in principle a complicated unit-commitment problem, with a large number of constraints and conflicting objectives;
- **SC and V2G technologies can be successfully achieved by optimisation techniques** – important techniques are genetic algorithm and particle swarm optimisation;
- **Proper SC and V2G management systems along with appropriate policies (incentive-based) are important for successful implementation of SC and V2G technologies**;
- **SC and V2G do come with some technical issues, mostly related to the stability (transient and dynamic) of the grid:** While modelling SC and V2G, it is essential to consider detailed and practical models (characteristics of real EV batteries) for steady-state and stability analysis; Precise forecasting of V2G capacity is paramount in both system and V2G operations. Improper forecasting, including for solar SC will have negative consequences for both EV users, fleet managers and grid operators.
- **Electricity price and economic benefits of EVs owners may be the most motivating factors to obtain load levelling, though perhaps other environmental considerations may help in terms of attitudes. However, if environmental costs were fully incorporated into the models and regulation/ policy for the sectors in questions, then they become a core explicit motivation also**;
- **Policy-makers should explore pursuing an ecological innovation policy, as distinct from a pure industrial policy, and embed this into both innovation policy and environmental policy at large.**

Illustration of Smart Energy Management / Energy Autonomy

The concept of smart energy management and V2X to improve the KPIs is illustrated in the figure on the right which does not represent the actual profile measurement of an investigated pilot. When PV is the only local production source, the energy storage (stationary battery or electric vehicle) is used to store excess generation from the PV (ES+) and supply this during the peak demand later in the day (ES-). The energy scheduling profile of the storage is illustrated by the green curve. The difference between an EV and a stationary battery (apart from the potential size difference) lies mainly with the fact that an EV (essentially used as a transportation vehicle) has constraints in terms of both availability and the associated vehicle battery State of Charge (SoC) requirements before journeys.

Component of EA	Effect of additional PV	Effect of additional storage	Effect of DSM
Self-sufficiency	Enhanced	Enhanced	Enhanced
Self-consumption	Enhanced	Enhanced	Enhanced

$$Self-sufficiency = \frac{Amount\ of\ local\ PV\ production\ consumed}{Total\ energy\ consumed} = \frac{C + ES^{+}}{A + C}$$

C represents the consumption directly supplied by RES generation in kWh.

B is the surplus RES generation energy after meeting the local demand in kWh.

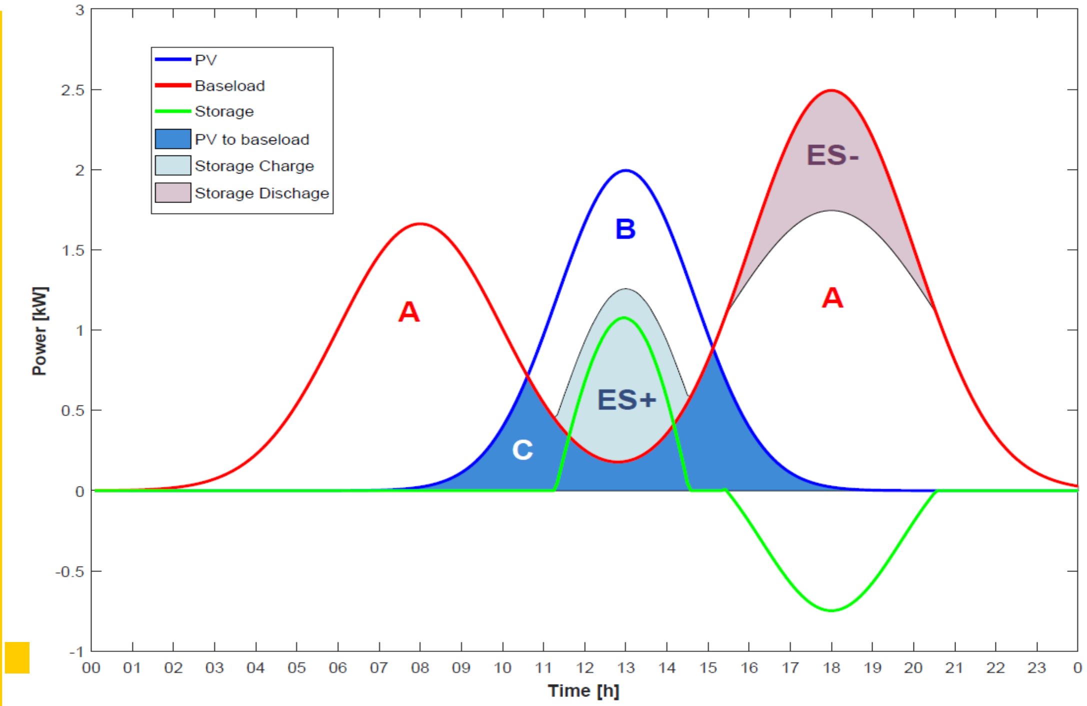
A represents local consumption not directly supplied by RES in kWh.

https://www.seev4-city.eu/wp-content/uploads/2020/09/SEEV4-City-approach-to-KPI-Methodology.pdf

Paper on **Pathways to energy autonomy – challenges and opportunities**
https://www.tandfonline.com/doi/full/10.1080/00207233.2019.1662219
https://www.seev4-city.eu/wp-content/uploads/2019/11/Bentley-et-al-Pathways-to-energy-autonomy-preprint.pdf

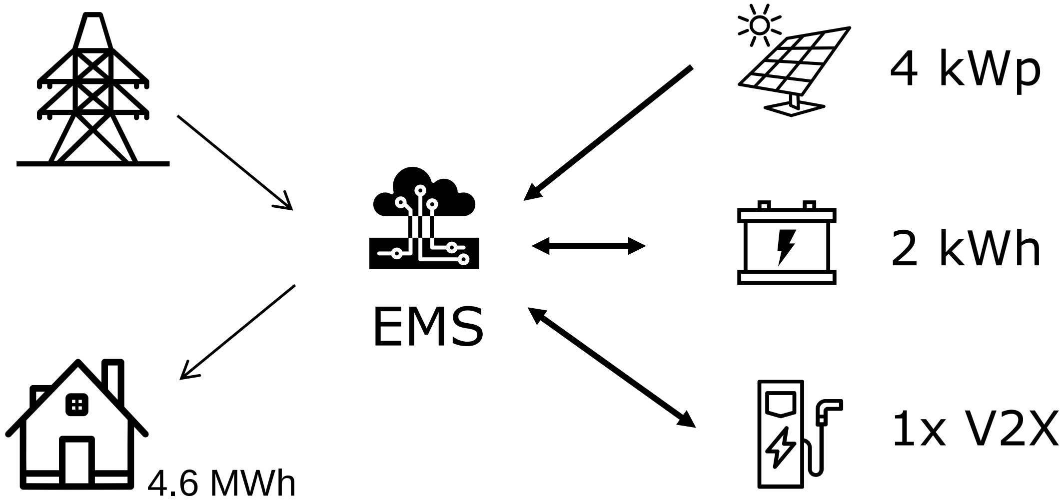
Self-Consumption: consumption directly supplied by RES generation/ divided by total generation

Self-Sufficiency: consumption directly supplied by RES generation divided by total load demand



Loughborough (UK)

Cenex employee home owner



Pilot characteristics

- A single household
- Vehicle used was a 24 kWh Nissan Leaf
- New installation in Burton-upon-Trent
- Equipment inherited from the EFES project

Key findings

Behind the meter

Commissioning

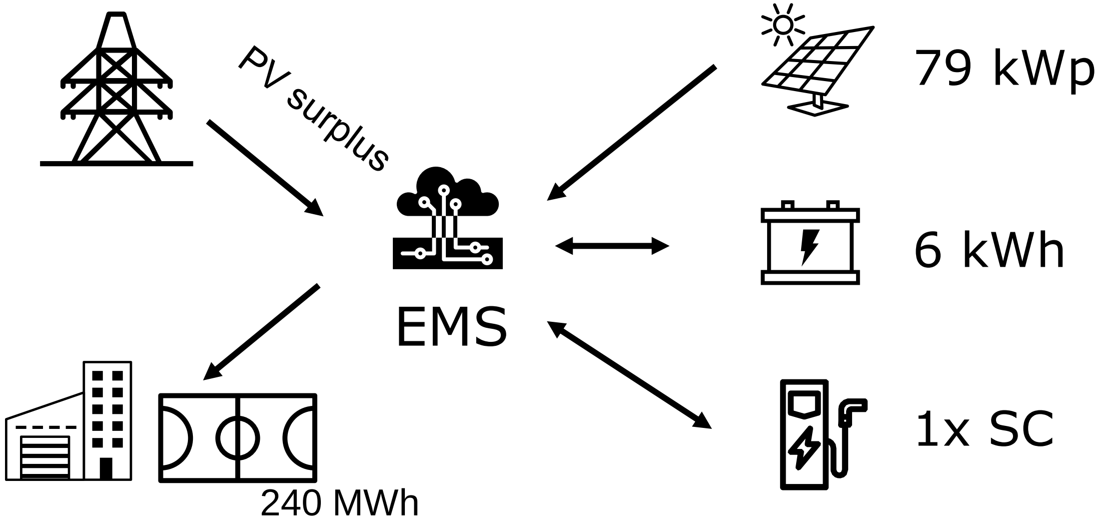
Almost 1 year

Kortrijk (BE)

The City Depot of Kortrijk

Pilot characteristics

- One Nissan E-NV200 that follows the same delivery route every day
- Self developed, python based EMS system to integrate all hardware by KU Leuven
- Epexspot (power exchange) for using flexible energy tariffs

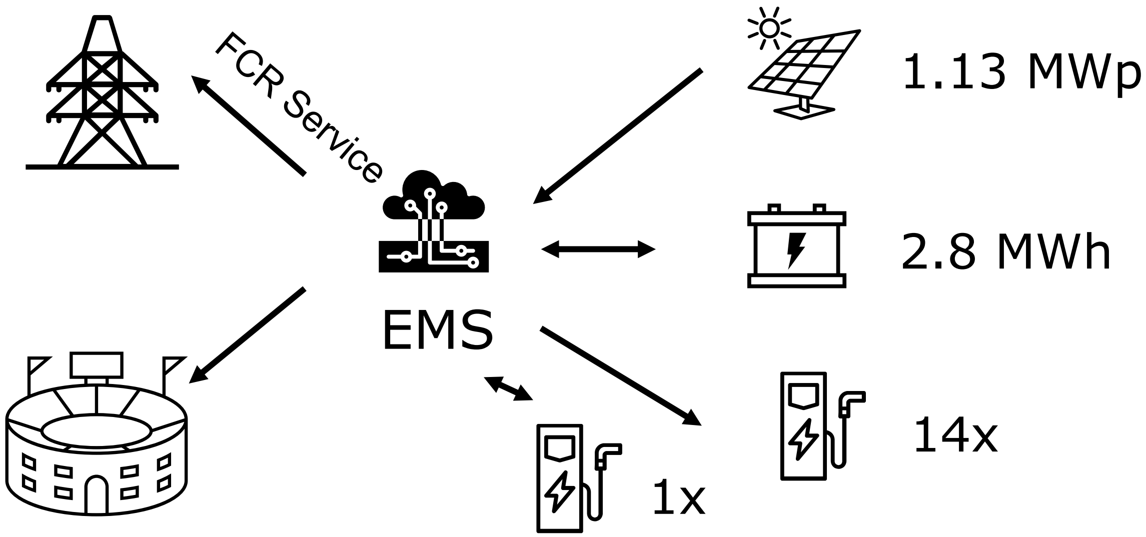


Amsterdam (NL)

Johan Cruijff Arena

Pilot characteristics

- 140 Nissan Leaf Battery packs
- Frequency Containment Reserve (FCR) outside event days
- Recently installed one V2X charger and 14 fast chargers



Key findings

9 years RoI

New and old batteries

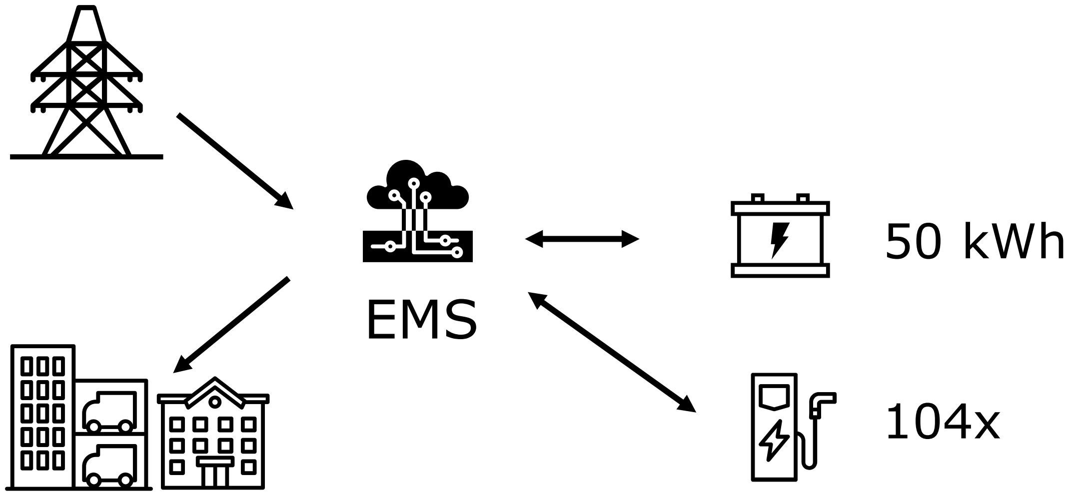
Free during events when V2X

Oslo (NO)

Vulkan Real Estate

Pilot characteristics

- 100 AC sockets semi-fast wall box charging points with SC capability (22 kW)
- 2x (4 sockets) DC fast charging (50 kW) with ChaDeMo and CCS
- Battery supports the garage at peak demand moments



Key findings

Responsibility

More details dataset

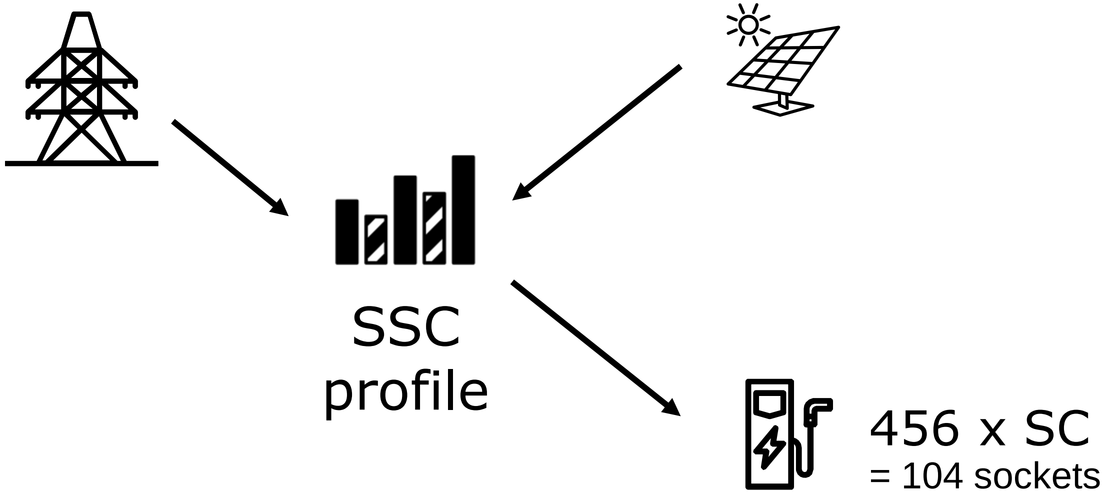
Choose charging speed

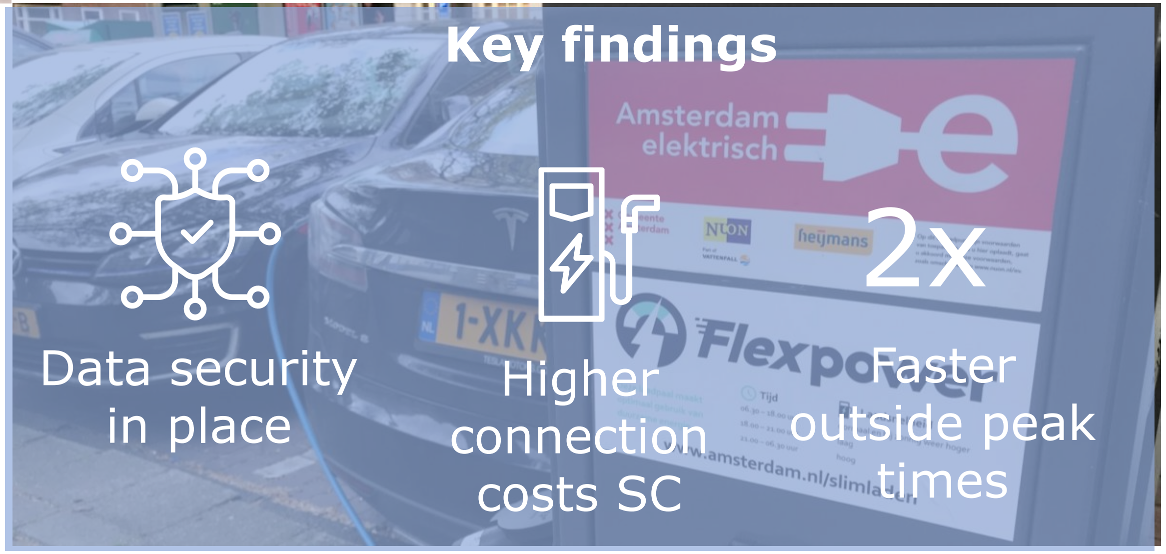
Amsterdam (NL)

Flexpower Amsterdam

Pilot characteristics

- Six Static Smart Charging (SSC) profiles
- Flexpower 2 recently started (456 charging stations = 912 sockets), with supply and demand matching of RE generation
- Upgraded charge points from 3x25A to 3x35A





Key findings

- Data security in place
- Higher connection costs SC
- 2x Faster outside peak times

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1

Technology: the V2X market is not fully mature

Technology in development

Procurement and installation may change

Expensive

V2X units are currently still very expensive

Car/Van compatibility

Not all EVs support bi-directional charging

OEM warranties

Manufacturers are reserved on providing warranties (depends on model and generation)

https://pure.hva.nl/ws/files/5676412/Lessons_Learnt_A_cross_case_analysis_of_six_real_time_Smart_Charging_and_V2X_Operational_Pilots_in_the_North_Sea_Region.pdf

2

Configuration: tailor-made projects

Merge different data collection systems

Pre-existing installations such as PV

Technical issues

Communication and compatibility

DNO requirements

Installation and operation behind the meter

Data security and privacy

Be mindful with the access to collected data

3

Procurement: knowing the market is key

Total system suppliers

Consortia for installation and operation

Procurement time planning

Components may have long lead-times

Investment in human capital

Invest in knowledge training

Know what suppliers offer

Product specifications and terms of supplier

4

Business models: V2X requires customised BM

Tariffs and type of consumer

Different regions and project purposes

Avoided grid investments

Location and network specific

Smart charging currently a better business case

Less expensive units and wider applicability

V2G may become more rewarding

If Feed-in-Tariffs are altered in the future

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Key current takeaways on SC and V2G

PRIORITIES

price and the availability of bi-directional charging units (V2G) are key barriers

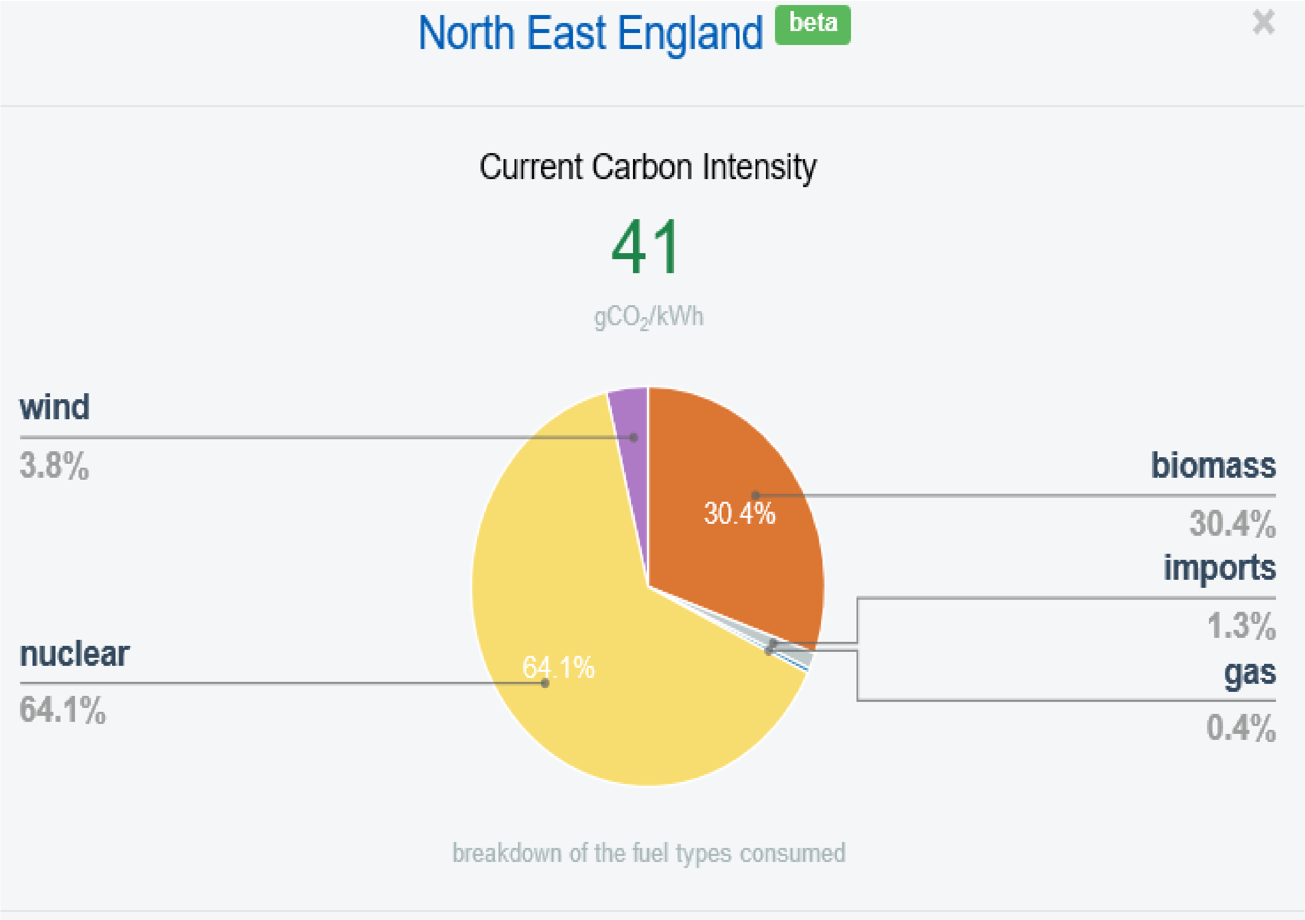
PROCUREMENT

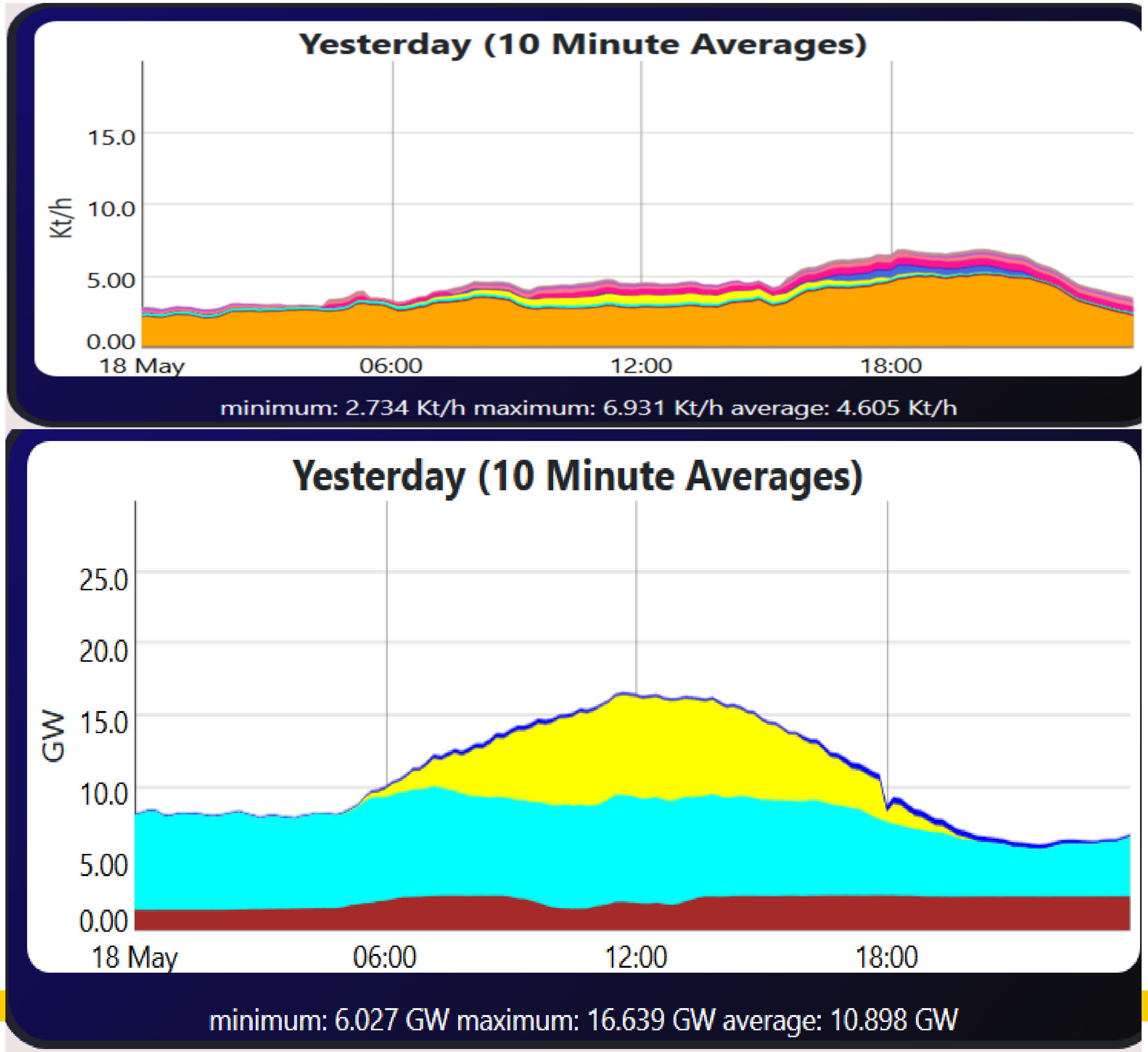
compatibility of the technology in general is poor

PERSPECTIVE

Smart Charging (SC) currently favourable, but V2X still holds potential

on the Left: https://carbonintensity.org.uk/ and on the Right: https://gridwatch.co.uk/co2-Emissions





https://ieeexplore.ieee.org/document/8759783

Carbon Intensity of Electric Vehicles by Grid Electricity Generation source

A feature of Ultra Low Carbon Vehicles (ULCVs) or Ultra Low Emission Vehicles (ULEVs) is their generally (significantly lower) **carbon intensity of the fuel sources** (electricity only in BEVs) compared to common ICE vehicles.

BUT: A critical feature here is the **carbon intensity of the electricity production** (energy mix going into that; from combustible fuels such as coal, petroleum and gas, nuclear and renewables sources such as hydro, wind, solar, biomass – and geothermal and tidal at a very low rate so far).

For the United Kingdom (UK), the *National Grid* - in partnership with the *Environmental Defense Fund Europe*, the *University of Oxford's Department of Computer Sciences* and the *WWF* - have developed the world's first Carbon Intensity forecast (API) with a regional breakdown, using **state of the art machine learning and sophisticated power system modelling to forecast the carbon intensity and generation mix 96+ hours ahead for each region in Great Britain**.

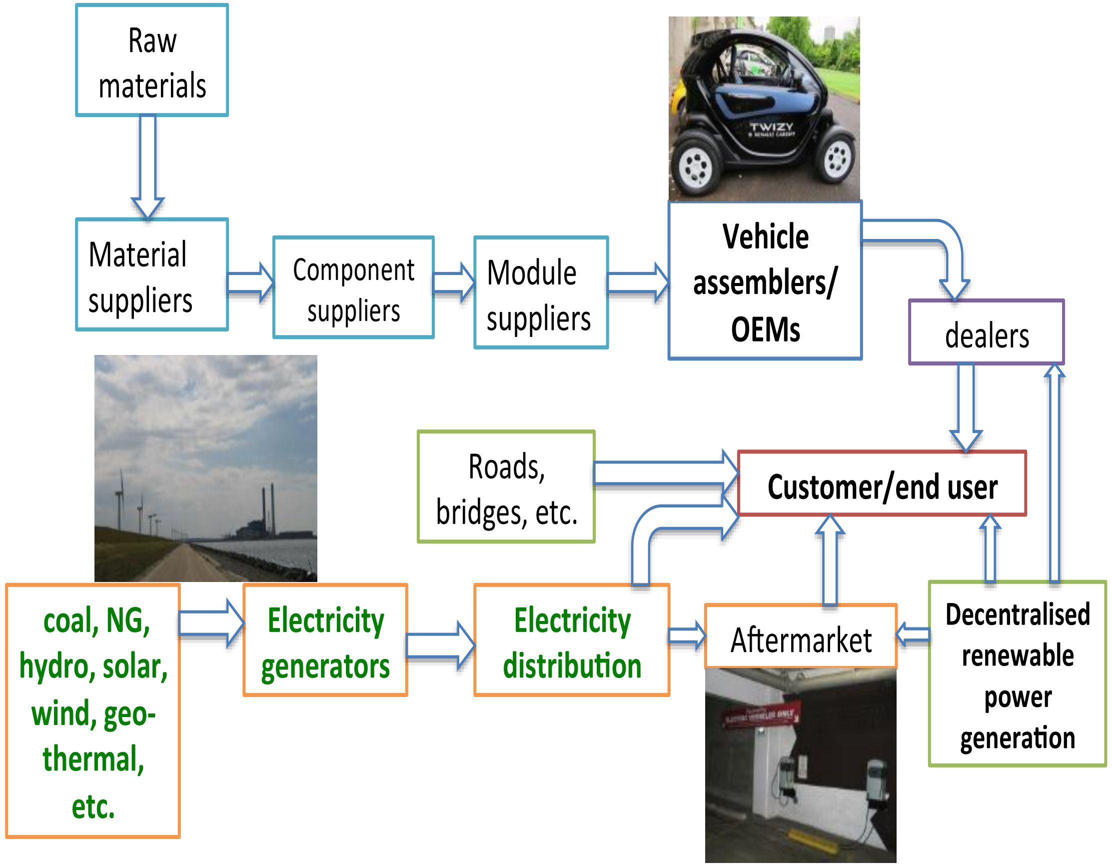
The OpenAPI allows consumers and smart devices to schedule and minimise CO2 emissions at a local level.

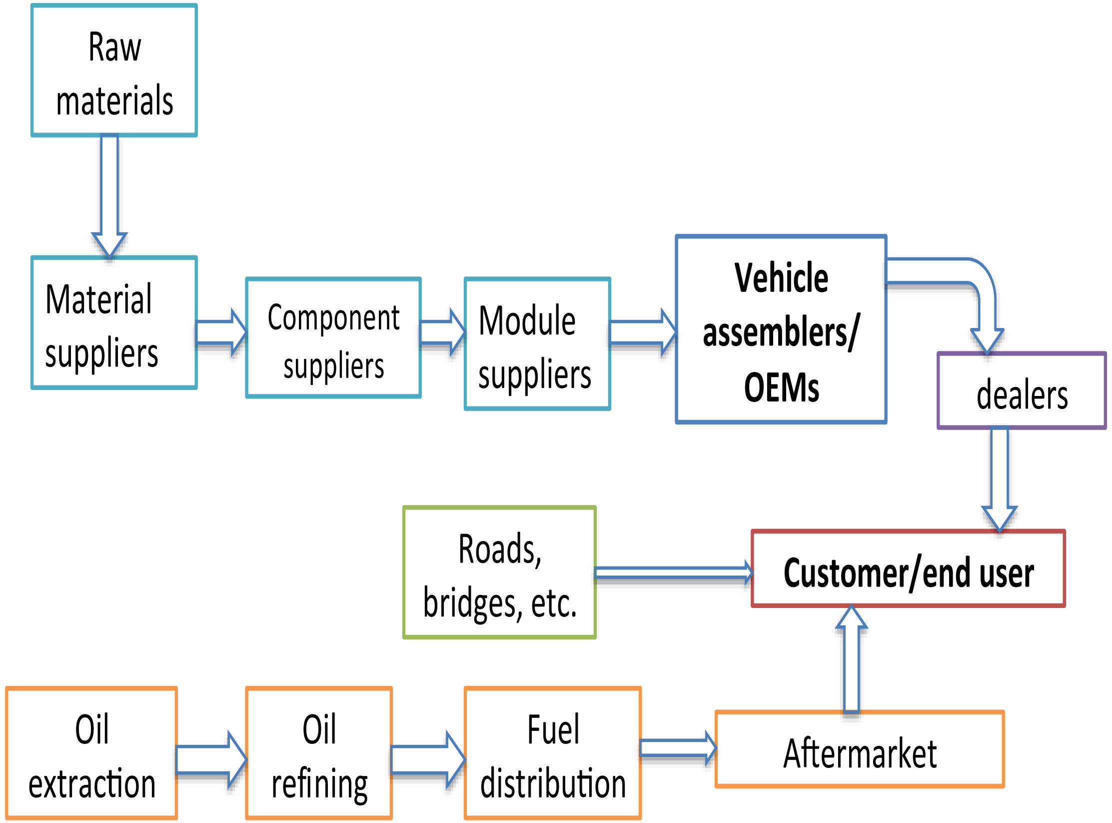
The regional data by 14 geographical regions in the UK, by Distribution Network Operator boundaries (DNOs).

https://carbonintensity.org.uk/

Value chain of the ICE automotive business model vs Value chain of the EVs business model

source: OECD, 2012, New Business Models for Alternative Fuel and Alternative Powertrain vehicles; an infrastructure perspective: https://www.oecd.org/futures/New%20Business%20Models%20for%20Alternative%20Fuel%20and%20Alternative%20Powertrain%20vehicles.pdf:- Accessed 23 May 2020.





EV development cycle

The complexity of EV development and its business success are dependent on a large number of variables, which need to trigger other prerequisites in the right sequence to bring technical progress - and as a result extensive mass production as part of an EV ecosystem.

Increase in EV sales (leasing /car sharing)

Increase in number of charging points (both publically stimulated by funding and private sector investments)

Increase funding and government support (in some areas, but focused more on Ultra Low Emission Vehicles and infrastructure – rather than hybrid)

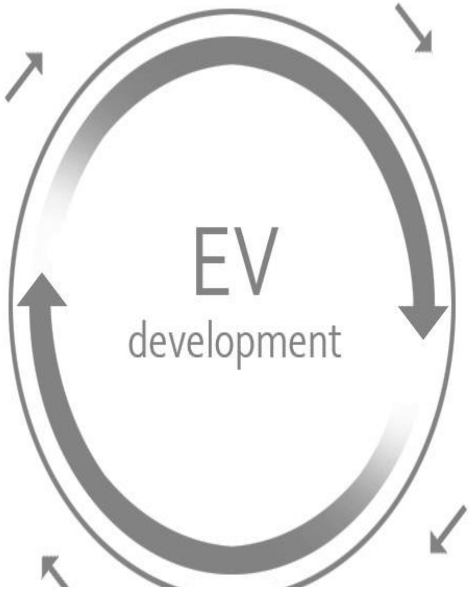
Increase in research activities (R&D) both from public and private sector

Decrease in vehicle weight – but also EV battery performance

Increase in performance and range

Increase in public approval and interest (also down to more testing by users and E-mobility information to wider target groups

Decrease in vehicle cost and battery (and also enabling infrastructure) cost



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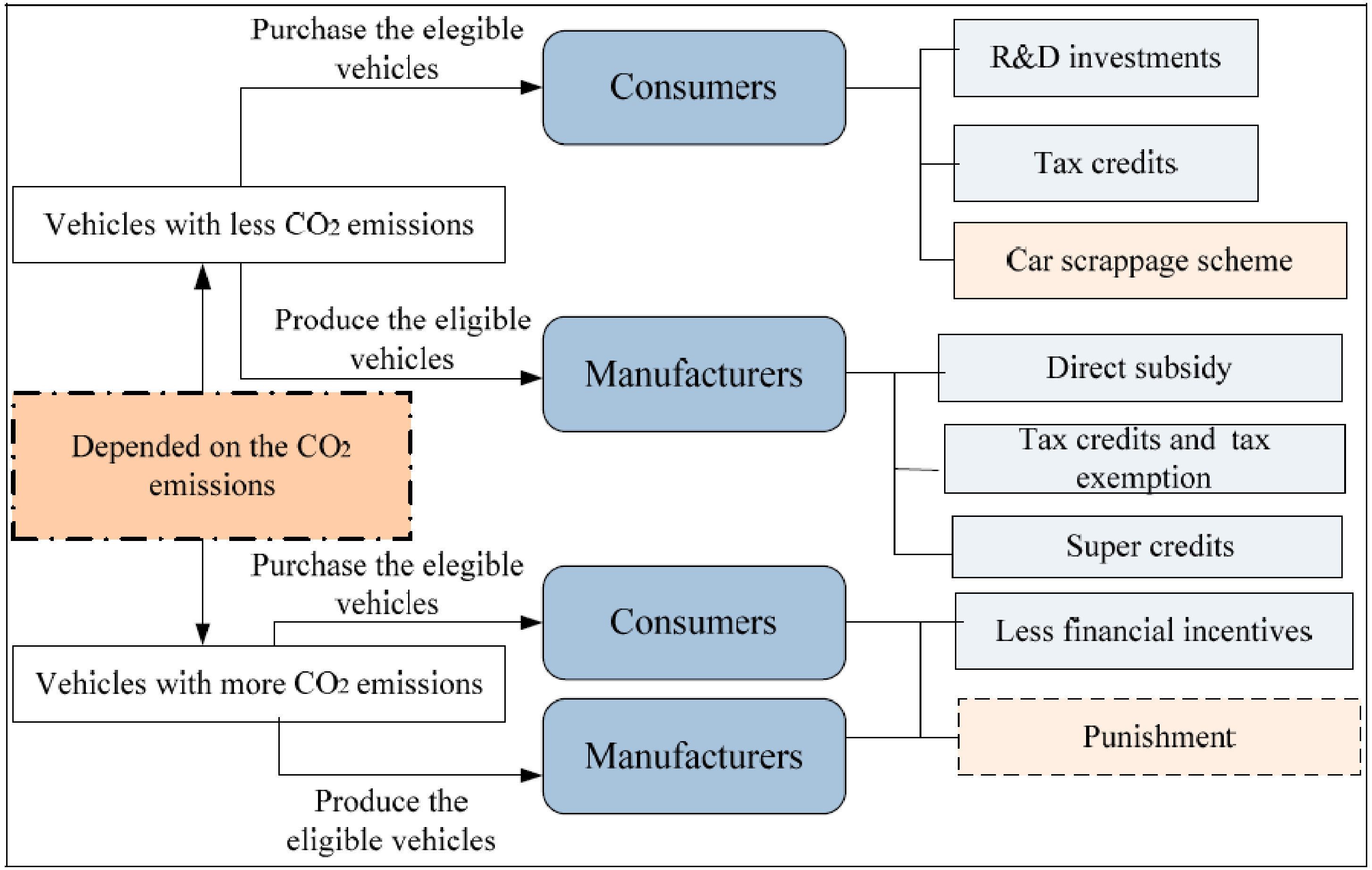
X. Zhang, J., Xie, R., Rao, and Y. Liang, 'Policy Incentives for the Adoption of Electric Vehicles across Countries', *Sustainability*, Vol. 6, pp 8056-8078, 2014.



"Ban on new petrol and diesel cars in UK from 2030 under PM's green plan"

BBC News, 18th Nov 2020

https://www.bbc.co.uk/news/science-environment-54981425

Potential means for reducing cost of EV (Modified Total Cost of Ownership / Use – MTCO / MTCU)

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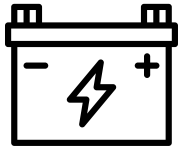
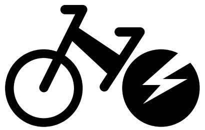
Reducing manufacturing costs, e.g. economies of scale; standardisation - and also Interoperability

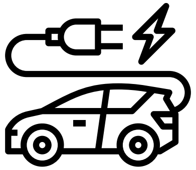


- New battery technologies.
- *Smart control to reduce degradation and extend battery life.*



- *Internalising CO2 emission costs into (road) transportation*

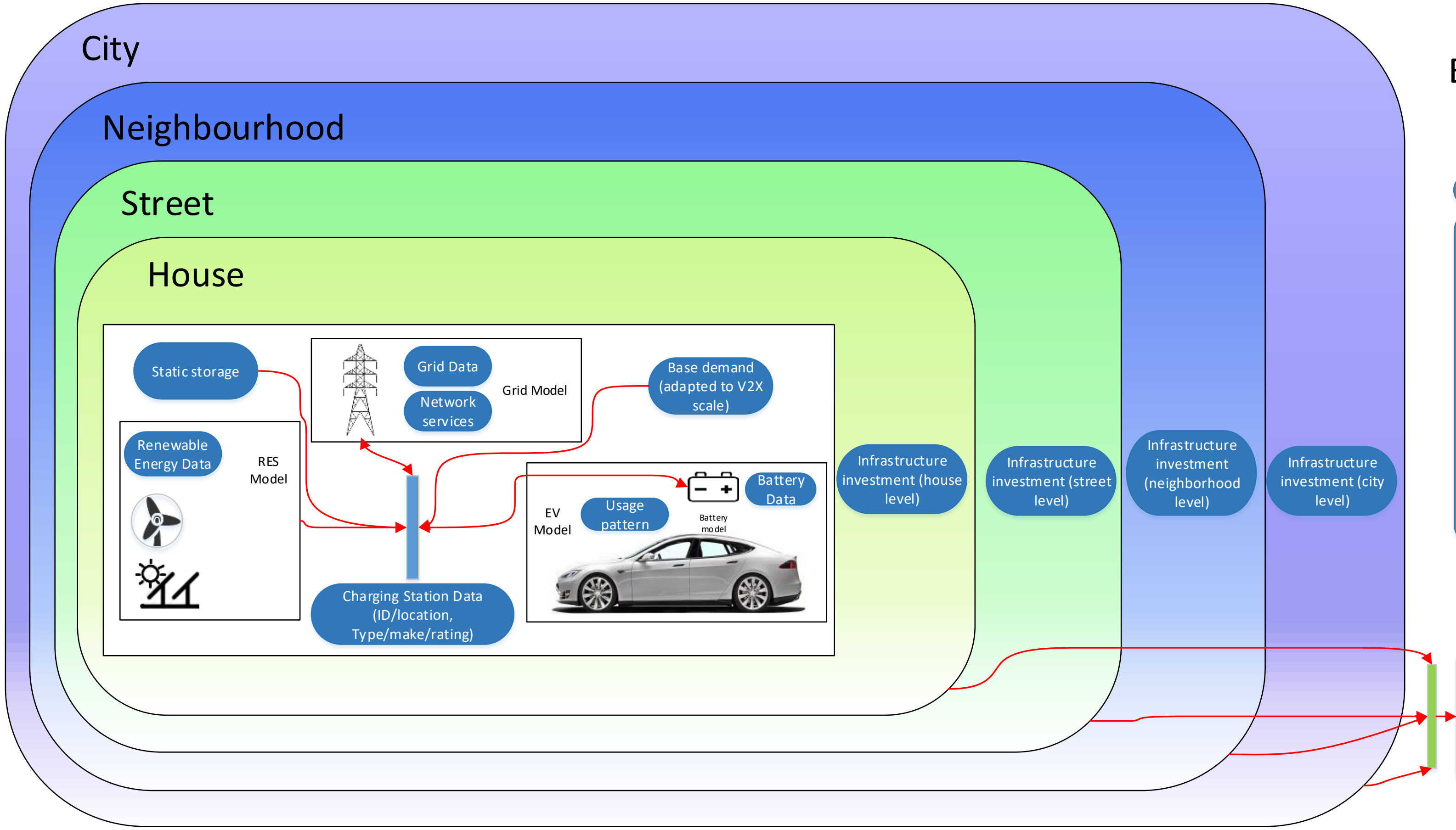
- *Find additional uses for the EV as part of a smart energy system,* support the grid and charge from available renewable energy.



- Energy aggregator models to be found that are commercial but attractive for all stakeholders – multi-objective optimization.

Electric vehicles + Electricity grid + Renewable energy + New technologies + Smart ‘pro-sumers’ + Appropriate policy
= Sustainable transport + electricity + supporting infrastructure + sustainable buildings

Vehicle-centred (need not be a car, but a van or even a bus in a depot – electric Vehicle for Energy Services (eV4ES)



Vehicle for Energy Services (V4ES)

Stakeholders

- Car Owners/Uers/Operators
- Grid Operators
- EV/RES aggregators
- Energy supplier/distributors
- Energy Consultant/Service Company
- EV Manufactures
- ITS providers
- ICT/Navigation service Providers
- EV Charging infrastructure owners/ manufacturers/Operators
- Infrastructure regulators
- Municipal authorities

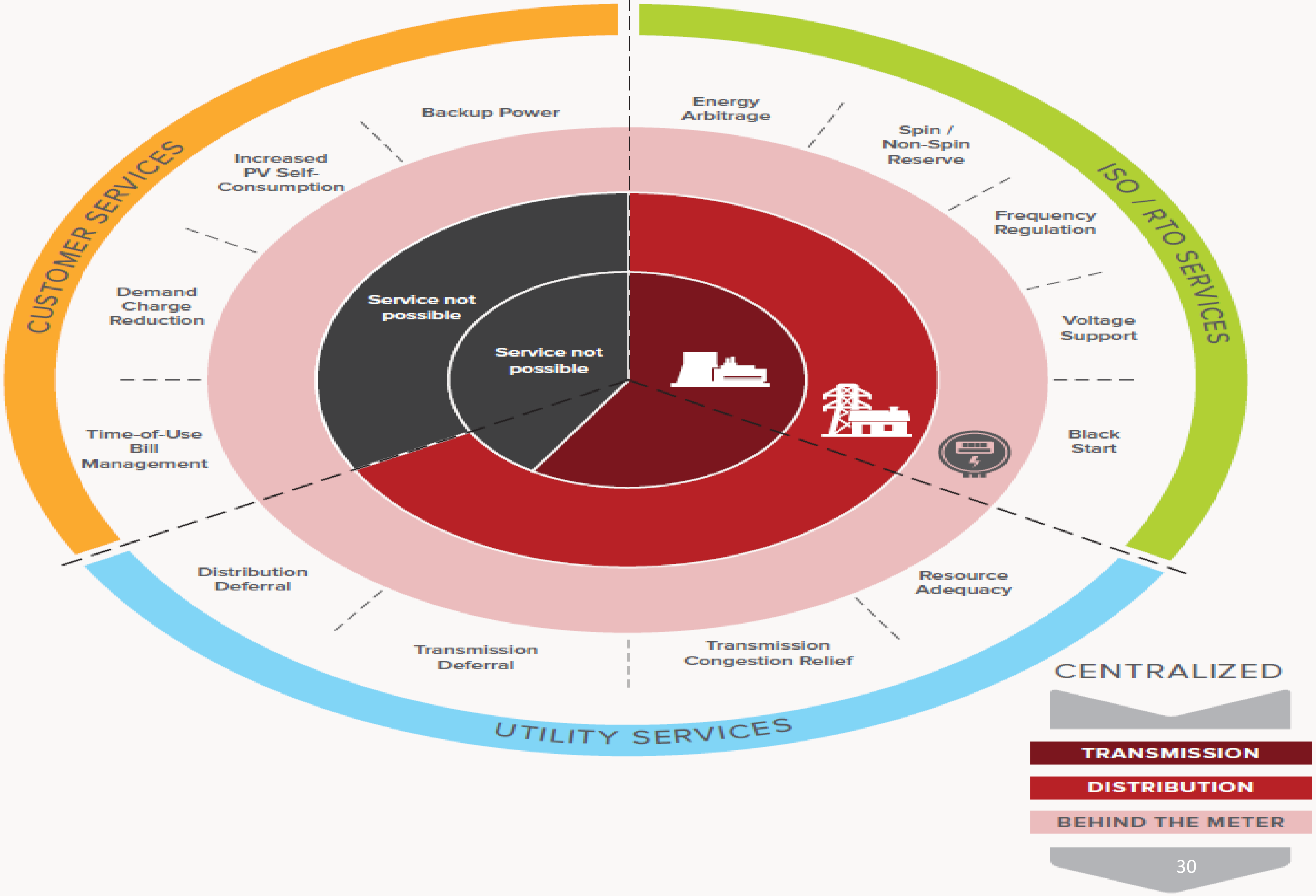
Model outputs

- CO_2 emission reduction, increased clean kilometer;
- Savings on TCO/TCU(Revenue from network service);
- User satisfaction

Rocky Mountain Institute,

"The Economics of Battery Energy Storage - How Multi-Use, Customer-Sited Batteries Deliver the Most Services and Value to Customers and the Grid",

October 2015.



Generic EV Business Model Structure

(credit: UNN SEEV4-City team)

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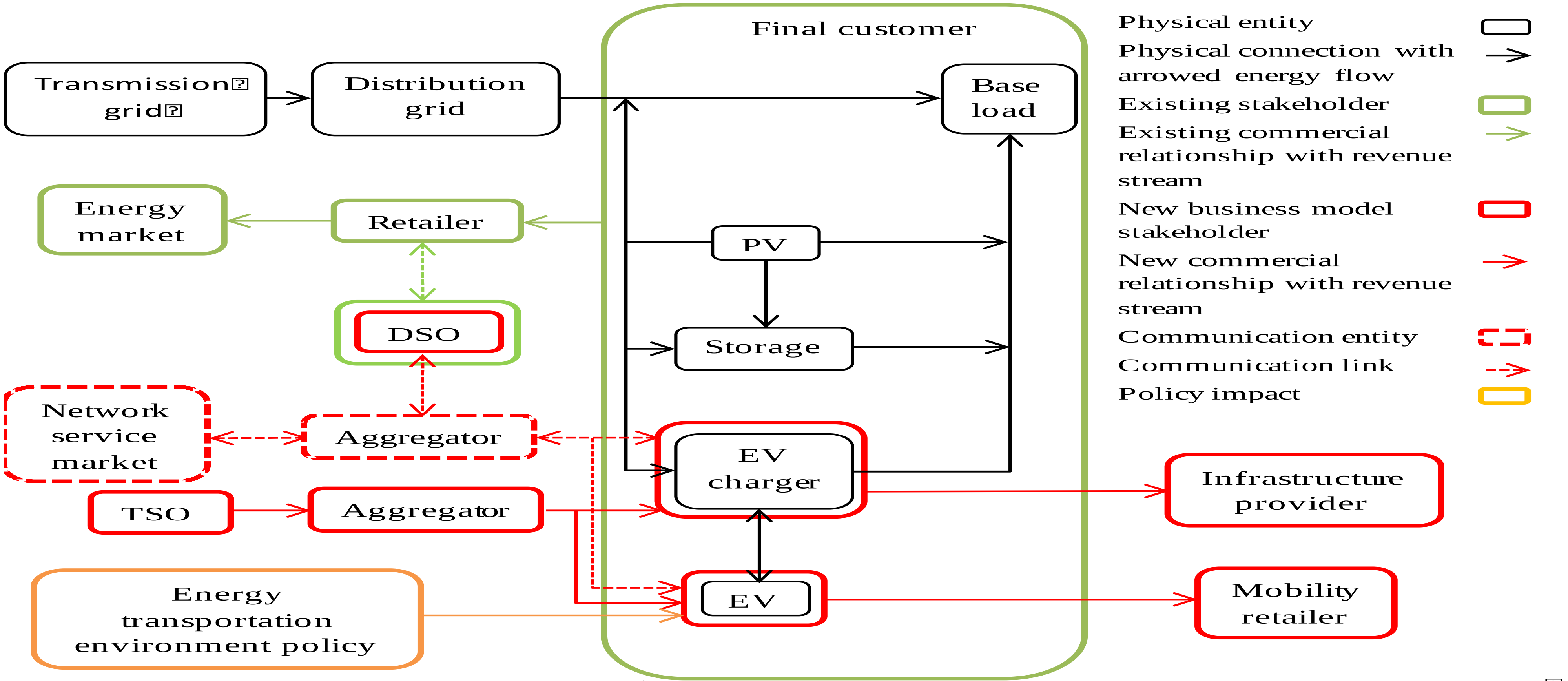

Business Model (BM) Pillars

Clean

- Target: CO2 emission minimization
- ICE (Internal Combustion Engine) substitution
- Energy mix (time dependent)
- Renewable (PV) integration

Energy Autonomy

- Target: energy autonomy maximization
- Smart charging and Demand Side Management (DSM) for load shifting
- Optimal utilization of static battery where applicable

Grid

- Target: minimize the deviations between supply and demand via smart charging and V2G
- Investment savings
- Smart charging to minimize the mismatch between load and PV
- Balancing services

M-TCO/U

- Target: minimize the modified TCO (Total Cost of Ownership) and TCU (Total Cost of Use)
- Provision of services to obtain revenue stream
- Subsidies and policies
- Battery life optimization

Credit: Ghanim Putrus, Richard Kotter, Edward Bentley, Yue Wang, Ridoy Das, Geoff O’Brien (all Northumbria University)

Recessions, Green Deals; all I need is an algorithm & app?

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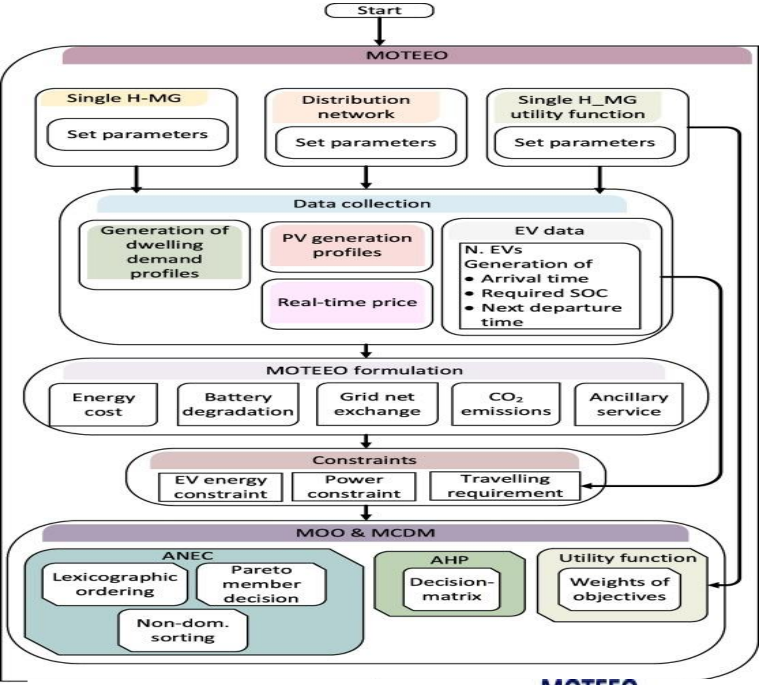
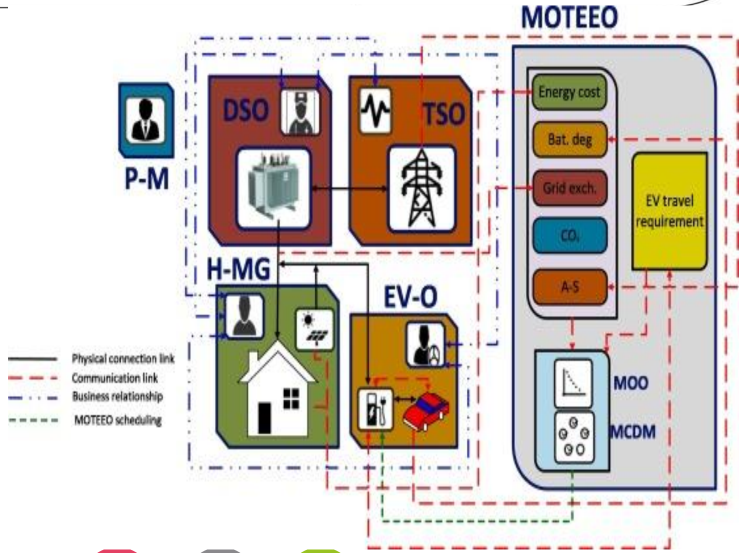
Business models for Smart Charging and V2G will become much more evident with Dynamic Electricity Pricing

EV Fleet-Centred Local Energy Systems (EFLES) project will start in May 2020 at UPS's Camden depot (https://www.edie.net/news/8/UPS-integrates-AI-software-at-Campden-depot-to-optimise-clean-EV-charging/)



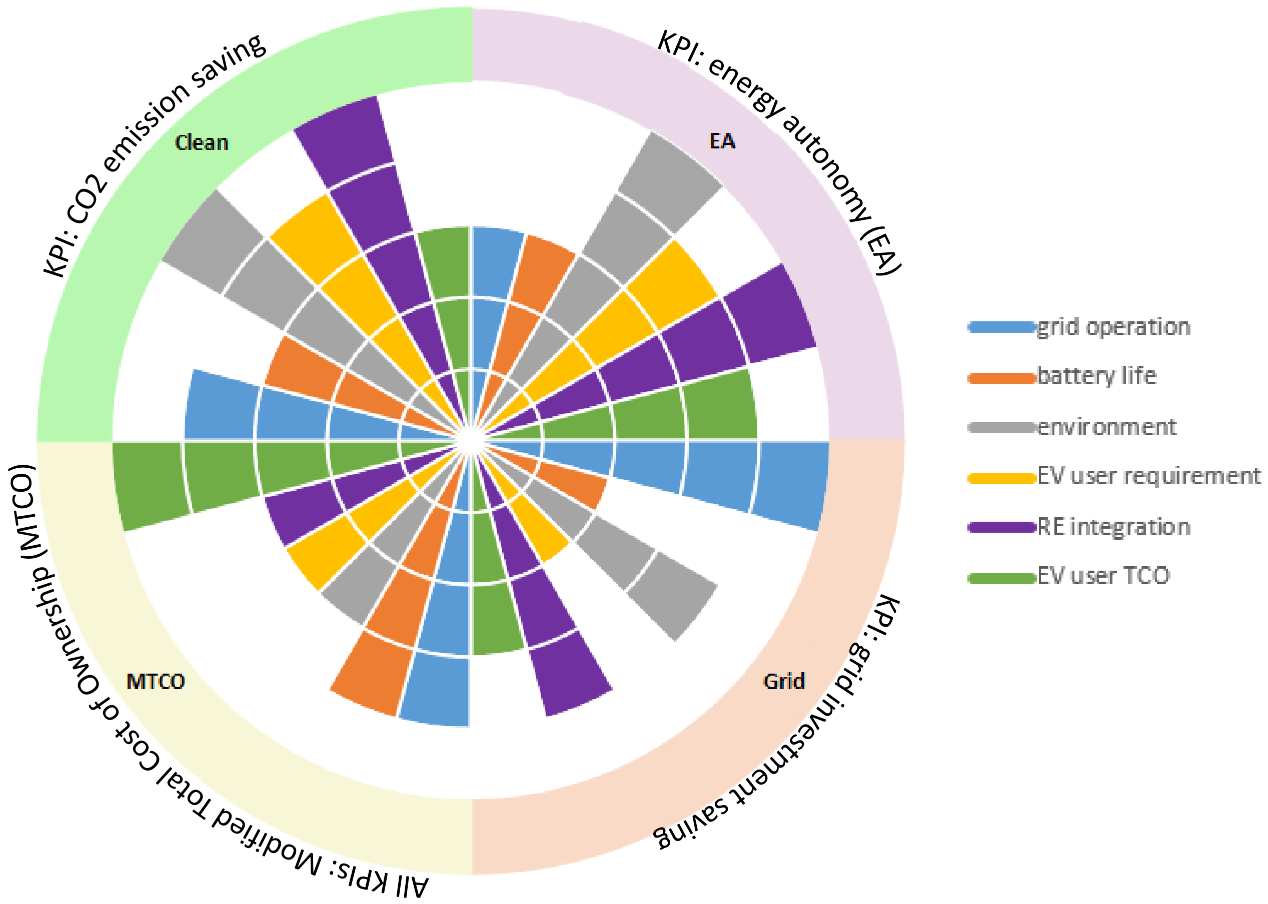


"… maximum achievable benefits along one objective only, and **there needs to be cooperation between the stakeholders to increase the overall social benefits. This suggests that a larger (or new) regulatory role must be played to ensure that overall social benefits are obtained**. The DSO must share the benefits achieved from improved grid utilization (investment cost deferral) by ensuring a revenue to the end-electricity user and the EV owner. The quantification of such revenue is case-dependent and each distribution network should be studied individually. Therefore, a collaborative decision process has been proposed. The implementation of a smart utility function under MOTEEO targets the peak demand by combining the objectives of the end-electricity user and the DSO achieving optimal grid operation while minimizing the damage to the battery …. **a holistic decision-making process under MOTEEO is required, as not doing so will inevitably result in sub-optimal consequences for other stakeholders and in the longer term, affect the social licence of that stakeholder and/or technology. Moreover, the MOTEEO framework allows costs and benefits to be quantified and discussed by the various stakeholders**. The application of this framework in future energy systems will engage multiple stakeholders, increasing the utilisation of renewable energy sources and integrating the energy and transportation system. **The cooperation among stakeholders through a decision-making process, as the one proposed in this paper, will bring overall societal benefits in future smart grids**.

https://www.sciencedirect.com/science/article/pii/S0306261919316526?via%3Dihub#f0005:

Strength / Focus of each BM Pillar – policy enhancement

- A range of dimensions and their strengths are set based on the **SEEV4City State-of-the-Art review**. http://www.northsearegion.eu/media/4384/summary-state-of-the-art-report-seev4-city.pdf
- There is a **trade-off among the pillars for the different OPs as they have different objectives**.
- The strengths will be evaluated before and after the implementation of the generic business model to the OPs.



- **EV user requirement should not be sacrificed in any case**, and this will be taken into account as a constraint during model development and implementation.
- **Policy** and route mapping **can increase the strength of any OP along part or all of the dimensions.**

Question / Challenge: How far can different policies stretch different Business Model Pillars ?
Credit for figure above: Ghanim Putrus, Richard Kotter, Edward Bentley, Yue Wang, Ridoy Das, Geoff O'Brien [all Northumbria University]

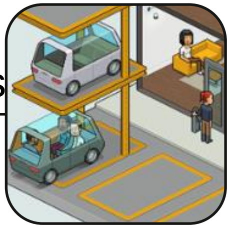
Business Model application category

Business model applications

Domestic

Smart charging and V2G are potentially beneficial through Demand Side Management and network service provision

Traffic hotspots



Car parking spaces, Business activity concentrations. SC and V2G opportunities.

Highway charging

Smart charging and V2G are not applicable due to travel pattern ?

Business areas

- Fleet operators
- Car rental/leasing clubs
- Work-based parking

Ownership based business structures

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Type	Definition
EV Private ownership	▪ The vehicle user is also the vehicle owner; ▪ The energy provider introduces time-of-use energy prices and FiT to the customer, and settles the transactions through an intermediate energy management agent; ▪ The customer must purchase the vehicle and the battery from the mobility provider and the infrastructure provider is responsible for the charging device.
EV Car leasing	▪ Private vehicle purchased via a PCP, i.e. leasing/renting; ▪ A personal lease consists of an upfront payment followed by regular monthly payments over a fixed period of time; ▪ It is usually cheaper than financing a vehicle outright as the individual is effectively renting the vehicle, but they do not own it; ▪ The risk of battery life curtailment is taken on by OEMs under a typical leasing agreement.
EV Car sharing	▪ By sharing vehicle, individual vehicle ownership is given up, which may be supported by a general trend where the interest in owning a car may be decreasing; ▪ Advantages: shift of vehicle ownership together with associated upstream and downstream risks to the service provision company; ▪ Disadvantages: high initial investment for purchasing the vehicles.

The main **V4ES/ES Services** are ...? – **they differ by (NSR) country** – **see: SEEV4-City State-of-the Art report**. **And**: “Stacking” – that is exploiting several non-conflicting (and policy-enabled) ones at any time is needed – **and it needs** to fit the customer profile …

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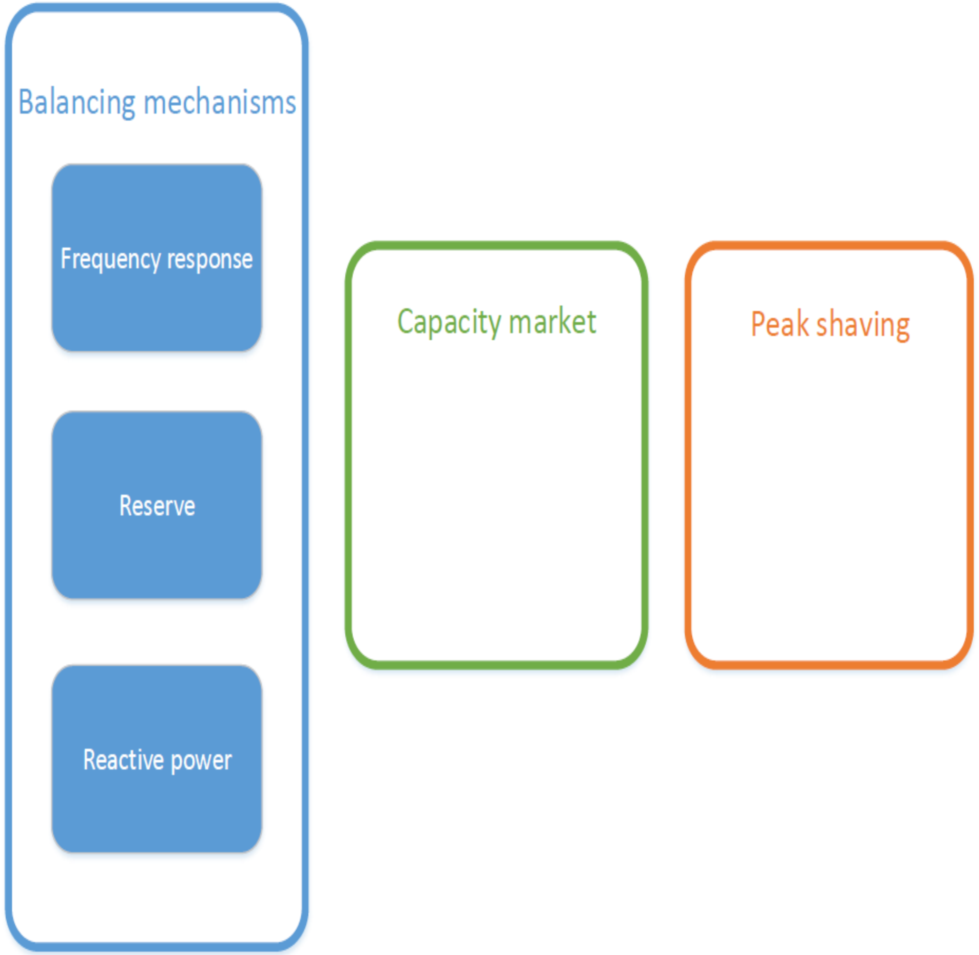

Cenex UK V2GUK study (2019): “Every customer is different, and each customer’s behaviour will impact their ability to access certain value streams … It is possible to group customers into ‘archetypes … **Cenex UK has identified a list of 16 domestic customer archetypes and 18 commercial archetypes which are believed to be representative of current and future customers for V2G.** Each archetype was assessed, resulting in the **following list of archetypes that provide high applicability to V2G and significant potential scale in the UK:**

- **Council fleet-Pool cars**
- **EV Car clubs**
- **Company car park**
- **The Retired Professional**
- **The Eco-Professional**
- **The Run-around (EV as 2nd Car).**

https://www.cenex.co.uk/app/uploads/2019/10/True-Value-of-V2G-Report.pdf;

The True Value of V2G? (Cenex UK, 2020)

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- Revenue-Generating Energy Trading:

The economic savings at a per-customer level may, in some cases … the savings at a national level would be significant and would result in lower energy bills for all customers.

- Resilience:

With V2G prices dropping, the provision of this service by V2G could replace a number of existing traditionally diesel back-up power systems or battery UPS systems, or reduce their usage. This would reduce or eliminate the costs associated with maintaining and operating these systems – producing economic benefits for the customer. In addition, there would be an environmental benefit (both nationally in terms of lifecycle carbon footprints and to local air quality for fossil-fuelled powered back-up power systems).

- Benefit to society:

This proposition focuses entirely on delivering environmental and societal benefits, which in turn should be returned to the customer by way of lower taxes and improved quality of life - for themselves and for future generations. Based on current evidence, V2G could extend the life of an EV battery by about 10%. By extending the life of the battery, V2G would help to reduce end-of-life waste and demand for mining of new materials, along with the emissions associated with these activities. Prolonging the life of an asset also allows customers to utilise vehicles over a longer period, reducing the total cost of ownership for the customer.

- Personal Net Zero/Self-Suffiency

Optimisation of self-consumption can be combined with arbitrage to create an economically and environmentally attractive proposition for customers. This works to increase the use of renewable energy local to the point of generation and avoid transmission losses and network operation/re-enforcement costs which would otherwise be passed on to the end customer through their energy bills. Taking a typical household with solar PV, this could equate to annual emissions savings of 0.6 tCO2e and energy savings in the region of £300, plus any benefits associated with avoided network investment.

"This summary shows that whilst this report separated the benefits of V2G into five individual value propositions, each will have indirect impacts and "in reality" the propositions are inextricably linked. Positive impacts are given here; however, it is imperative to consider any negative emergent behaviour when considering value propositions. For example: what is the impact of optimising the revenue generation for arbitrage on the vehicle battery health; would optimising the use of V2G for wider societal benefit come at the financial expense of the operator?" https://www.cenex.co.uk/app/uploads/2020/06/Fresh-Look-at-V2G-Value-Propositions.pdf

Classification of SEEV4-City OPs – derived business models

https://www.seev4-city.eu/wp-content/uploads/2020/08/Business-Models-for-SEEV4-City-Operational-Pilots.pdf

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Smart Charging Strategy	Optimization Strategy
Postponing EV Charging- arguably not specifically applicable in SEEV4-City, with perhaps the partial induced exception for residents at Vulkan Oslo OP, and also Loughborough-Burton-upon-Trent OP	**Grid congestion / reducing peak power demand** – Flexpower Amsterdam, Johan Cruiff ArenA, and Vulkan Oslo car parking garage OPs; marginally at Kortrijk and perhaps Leicester City Hall, and if scaled up at Loughborough/Burton-upon-Trent across similar households
Cut and Divide – dividing EV charging sessions – arguably Loughborough/Burton-upon-Trent OP	**CO_2 emissions reductions** – all SEEV4-City OPs, though not all with locally generated Renewable Energy (RE) within OP systems boundary (and some with a mix of locally generated and central grid imported RE electricity sources); some OPs also enabled with a stationary battery energy storage (BESS)
Slower Charging Strategy – compensated for by possible Faster Charging at off-peak times- at Flexpower OP in Amsterdam	**Energy Autonomy / increased self-consumption and /or self-sufficiency** – Kortrijk and Loughborough/Burton-upon-Trent OPs
Vehicle-to-Anything (V2X) – Johan Cruiff ArenA, Loughborough/Burton-upon-Trent, and Leicester City Hall OPs	**Economics / reduce charging costs by matching with energy markets, and potentially gain net revenues by grid services** – Johan Cruiff ArenA, Loughborough/Burton-upon-Trent OP

https://www.seev4-city.eu/wp-content/uploads/2020/08/Business-Models-for-SEEV4-City-Operational-Pilots.pdf

- **For each Operational Pilot, two business models are presented:**

the current 'derived' business models, understood to be put in place at the beginning of the respective SEEV4-City OP, and changes made to them during the life-time of the Ops; and the proposed improved business models. Some of the proposed business models are indeed partially implemented during the course of SEEV-City through feedback loops and optimisation and others remain for future consideration and implementation after SEEV4-City. Due the heterogeneity of the SEEV4-City Partnership overall as well as the diversity of the composition of local partners and stakeholders across and in the respective OPs, that viable here does not necessarily mean profitable (or surplus-creating for the not-for-profits) but organisationally feasible and sustainable financially to meet key objectives against stated policies. This in turn should see the credit from internalising costs (including environmental) which have previously been externalised and not taken care of.

- Some of the OP business models reviewed in this report are likely to be able to meet (prior to Covid19) roughly their planned returns on investment, for others it is more about identifying a more partially commercial set-up with reliable partners (including aggregators) which can monetise what previously was only hypothetical V4ES due to the small scale. **For others, a policy reform is needed to benefit from, or not to be penalised inadvertently by, grid-facing energy interactions. Some form of net savings is found to be possible with a degree of electrical energy autonomy (behind the meter).**

- **In all circumstances, battery degradation needs to be factored in as well. A key for increasing the confidence of EV users to participate in V4ES is to have a dynamic model for battery state-of-health that can be used in real-time.**

- Finally, **V4ES involves complex interactions between several stakeholders with potentially conflicting interests, which need to be carefully considered and optimized. There is no single business model that will fit all V4ES implementations. A successful and commercially viable V4ES business models need to be tailored so that all stakeholders involved can see benefits (win-win scenarios).**

- Also, V2G value propositions in Europe may change over the next few years with refined legislation, competition in the market between (fleets of) EVs and stationary batteries and may do so differently in different countries.

Key conclusions and recommendations for upscaling of pilot new (electric Vehicle4)Energy Services

- **To better incentivize customers to charge smartly, and facilitate flexible / dynamic power profile solutions**

→ allow room (to explore) price differentiation (national legislation)

• **Infrastructure costs / static energy storage and grid/tariff related policies often form significant barrier / long Return on Investment**

→ market needs to be stimulated to increase supply diversity/ choice

• **Lessons from EV market for ebike market**

→ charging infrastructure standardisation / solar charging stations

• **Awareness and engaging (end)customers is key to success of many solutions**

→ include as stakeholders from the start

• **Adoption of such services involve several different stakeholders / partners and new knowledge**

→ invest (time) in human resources to build own knowledge and understand the market

SUMP: Sustainable Urban Mobility Plans (SUMPs) – with SUMEP relevance check

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origin: 2011 White Paper Transport; 2013 EU Urban Mobility Package

- **Goal:** providing **integrated solutions to transport and mobility needs of people and goods, guaranteeing technical, economic, environmental and social sustainability.**
- **Key concepts:**

- **accessibility to all road users;**
- **balanced development of all transport modes;**
- **efficiency and cost-effectiveness;**
- **optimizing use of urban areas;**
- **more attractive cities and better quality of life;**
- **road safety and security.**

The 8 SUMP principles

https://www.eltis.org/mobility-plans/sump-concept

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Is there a need for SUMEPs (Sustainable Urban Mobility and Energy Plans) ?

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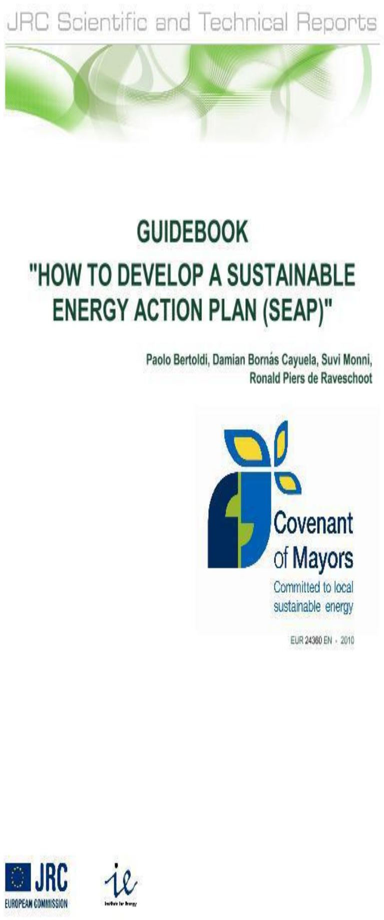

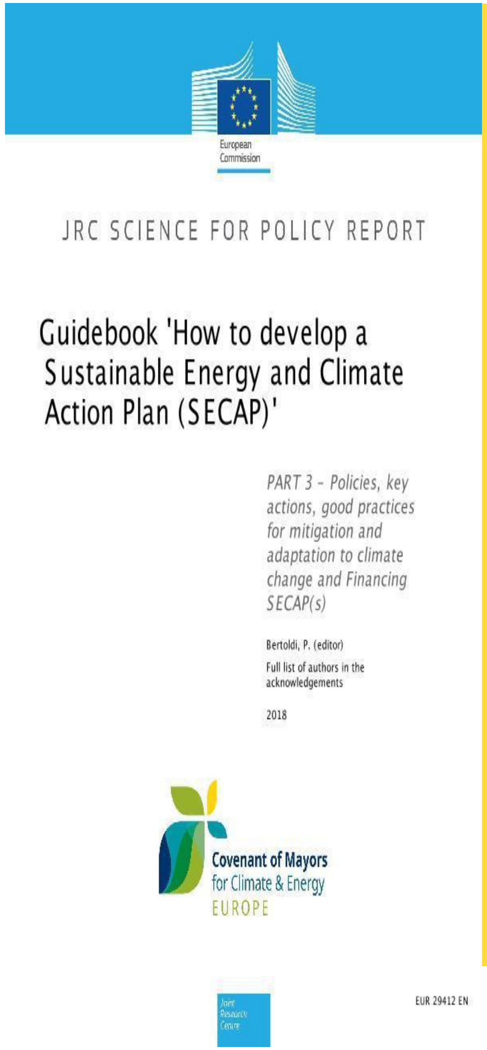

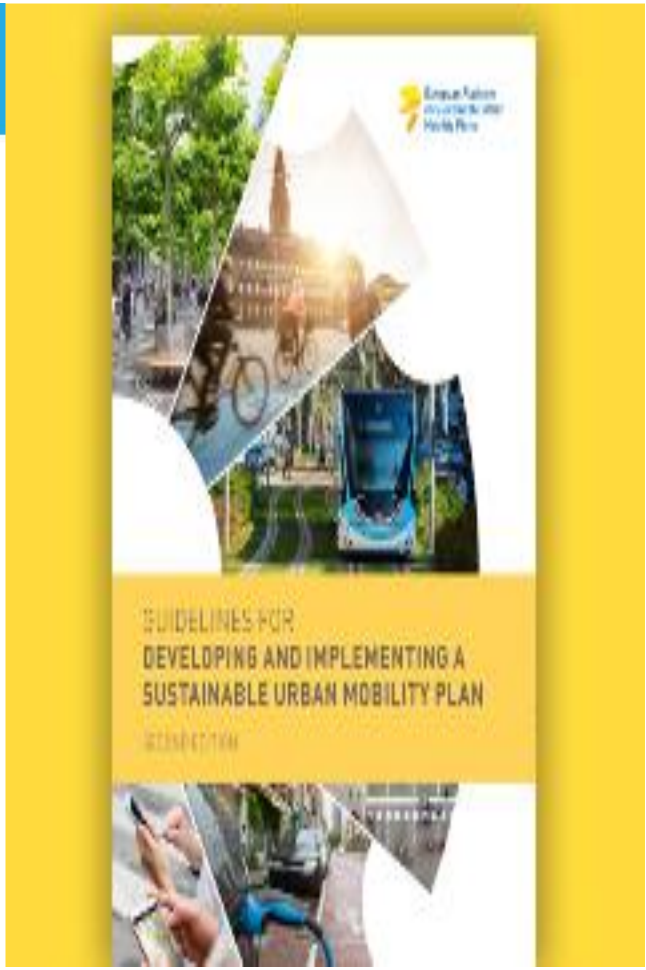

- Linking transport and health in SUMPs: How health supports SUMPs)
- Harmonisation of Energy and Sustainable Urban Mobility Planning)
- Sustainable Urban Logistics Planning
- Electrification: Planning for electric road transport in the SUMP context)
- Funding and Finance of Sustainable Urban Mobility Measures
- Integration of Shared Mobility Approaches in Sustainable Urban Mobility Planning
  The Role of Intelligent Transport Systems (ITS) in Sustainable Urban Mobility Planning: Make smarter integrated mobility plans and policies
- Mobility As A Service (MAAS) and Sustainable Urban Mobility Planning
  Public Procurement of Sustainable Urban Mobility Measures
  Urban Road Safety and Active Travel in Sustainable Urban Mobility Planning
- UVAR and SUMPs: Regulating vehicle access to cities as part of integrated mobility policies
  Sustainable urban mobility planning in metropolitan regions

ANNEX: GOOD PRACTICES COLLECTION: Sustainable urban mobility planning and governance models in EU metropolitan regions

SECAP – a planning process / SUMP – a cycle

https://e3p.jrc.ec.europa.eu/sites/default/files/documents/publications/guidebook_how_to_develop_a_secap_in_mena___region_final.pdf /
https://www.eltis.org/mobility-plans/sump-process

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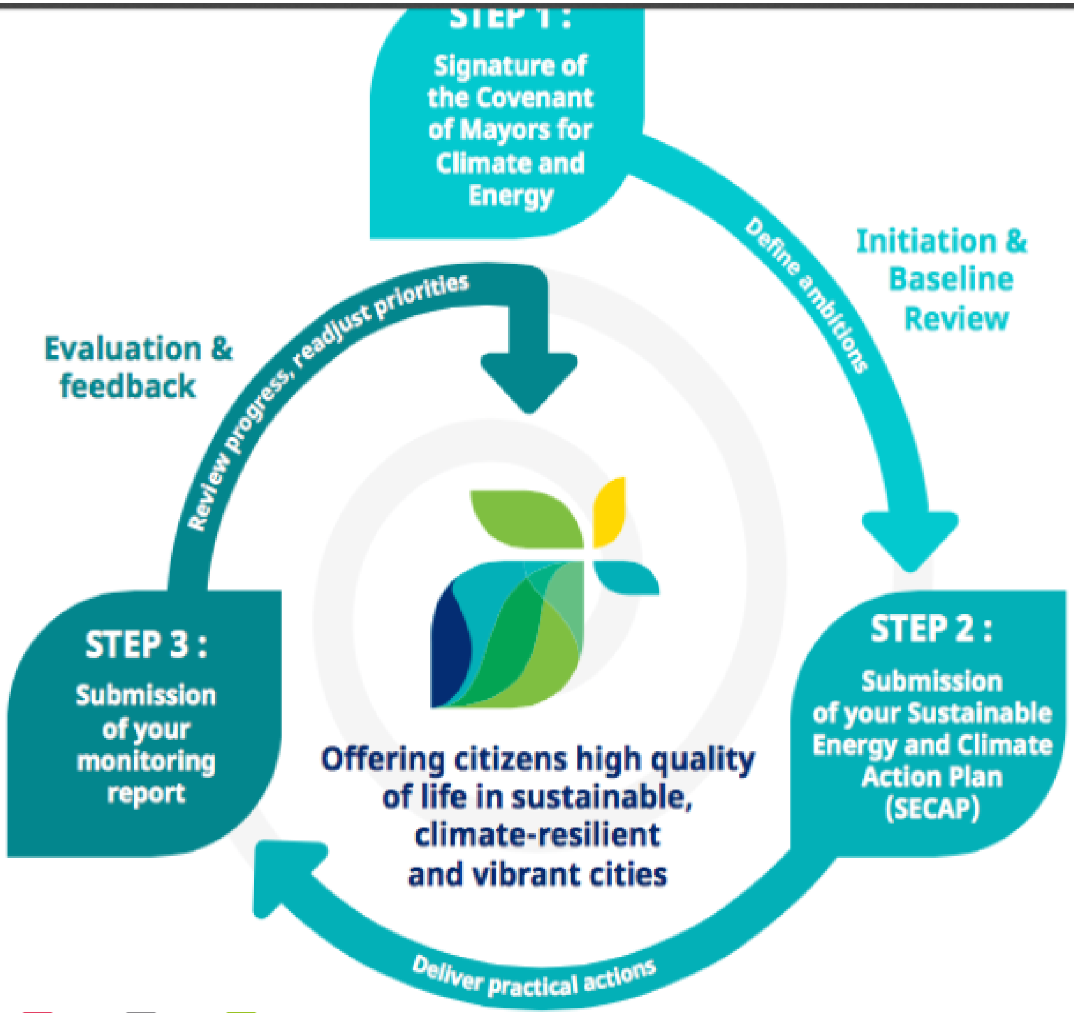

Sustainable Urban Mobility and Energy Planning/Plans (SUMEP/s)

SEAP and SECAP as well as SUMP, including guidance / processes, can in themselves be characterised as separate policy-packages. One could add to this also “Mayors Adapt”- The Covenant of Mayors Initiative on Adaptation to Climate Change, as it also covers energy, buildings, transport, and is urban focused.

No one single policy in any of the domains of transport/ mobility, energy/ climate change and smart grid policy alone will be fully effective; rather, “a host of measures will have to be implemented for policy action to bring about desired change and to be successfully implemented.” (Givoni, 2014: 1)

Integrating these packages will bring benefits regarding decarbonisation of energy production, generation, distribution, supply, and consumption as well as energy storage to achieve (ultra-) low carbon SUMEP. The integration needs to be made in the context of increasing electrification of energy infrastructure and transport together with the local and central electricity grid, as part of the move towards a “Smart Grid”. The Smart Grid approach also entails an increase in distributed energy sources (usually renewables) and ‘pro-sumers’ (who both produce and consume electricity), electric Vehicle-for-Energy-Services (eV4ES) also need to be considered and integrated here.

“policy-packaging”

The editorial of a special issue of the journal *Transportation Research Part A* (Vol. 60, pp. 1-8; in the field of transport) suggests that **policy-packaging (of measures and interventions) is needed yet (then) in its infancy, and distinguishes it from “just a list of policies”.** It is suggested that: “To increase the probability of policy ‘success’ a range of policy options (measures) should be explored and implemented. The way that these many policy measures are considered and implemented must be carefully considered, to **utilise synergies between measures and to avoid potential contradictions between them when it comes to one or more policy objectives.”**

By ‘Policy-Packaging’ Givoni and the special issue contributors refer to “the **approach of strategically considering a wide range of policy measures to address a policy problem and implementing them in coordination**. (Givoni, 2014: 1).

Givoni (2014: 6), drawing on Conklin (2005), suggests that **complex (‘wicked’) problems have a relationship with characteristics of policy-packaging. This suggests that “policy packages cannot be assessed until implemented”, “policy-packages have no stopping rules”, “every policy package is essentially unique and novel”, “every policy-package is a one-shot (but long and dynamic implementation operation” and that “a specific policy package has no clear alternatives (but countless variations of it)”.**

SEAP towards SECAP – check with SUMEP

(see SIMPLA [Sustainable Integrated Multi-sector Planning] EU H2020 project)
modified from:
https://civitas.eu/sites/default/files/1.how_can_sumps_and_seaps_work_together_f.tomasi.pdf

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SEAP: Sustainable Energy Action Plan

- **Covenant of Mayors (2008 Climate and Energy Package)**
- **Role of local authorities in the implementation of sustainable energy policies (mainly: buildings, equipment and facilities, transport, generation of electricity, heating and cooling)**
- **NOT just council-owned buildings !**
- **Scope: climate mitigation by means of a reduction in fossil fuels consumption**
- **Objective: reducing CO_2 emissions by min. 20% by 2020**
- **Focus on: energy efficiency and energy from renewables**

SECAP: Sustainable Energy and Climate Action Plans

- **Covenant of Mayors for Climate and Energy (2015)**
- **Role of local authorities in climate change mitigation and adaptation policies**
- **Objective: reducing by at least 40% CO_2 and other GHG emissions by 2030 + a risk and vulnerability assessment of the effects of climate change**

that means, inter alia, protecting your critical infrastructure, including utilities / electricity, from flooding and outages and black-outs – link to Energy Autonomy in SEEV4-City

Integrated emergency management/ planning and disaster management

SEAP compared to SUMP – with SUMEP relevance (and social equity / justice)

Sustainable Energy Action Plan

- Objective is CO_2 emissions reduction
- Baseline with comprehensive overview of energy generation / consumption
- Single scenario: 2020 vs Baseline Emission Inventory (BEI) year
- Centralised Monitoring by Covenant of Mayors Office
- Energy Poverty / Energy Justice ?
- Energy Sufficiency !

Sustainable Urban Mobility Plan

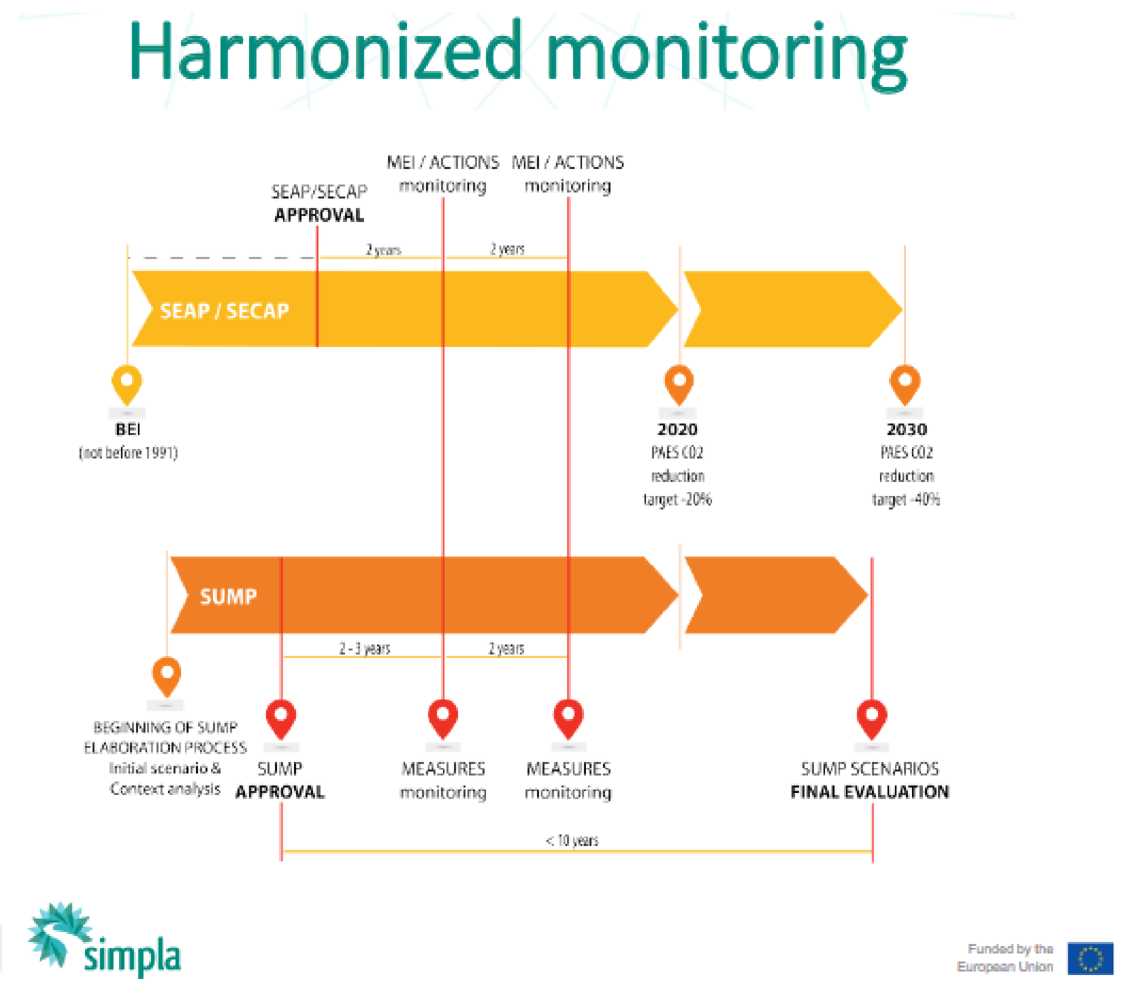
- Objective: improve quality of life

[inter alia, this includes air pollution]

- Context analysis based mainly on transport infrastructure, mobility and socio-economic data
- Comparison of scenarios
- Decentralized monitoring directly by the local authority in question
- Social Impact Assessment
- Transport/Mobility Sufficiency!

The SIMPLA solution to harmonizing SEAP/SECAP and SUMP planning processes

https://civitas.eu/sites/default/files/1.how_can_sumps_and_seaps_work_together_f.tomasi.pdf



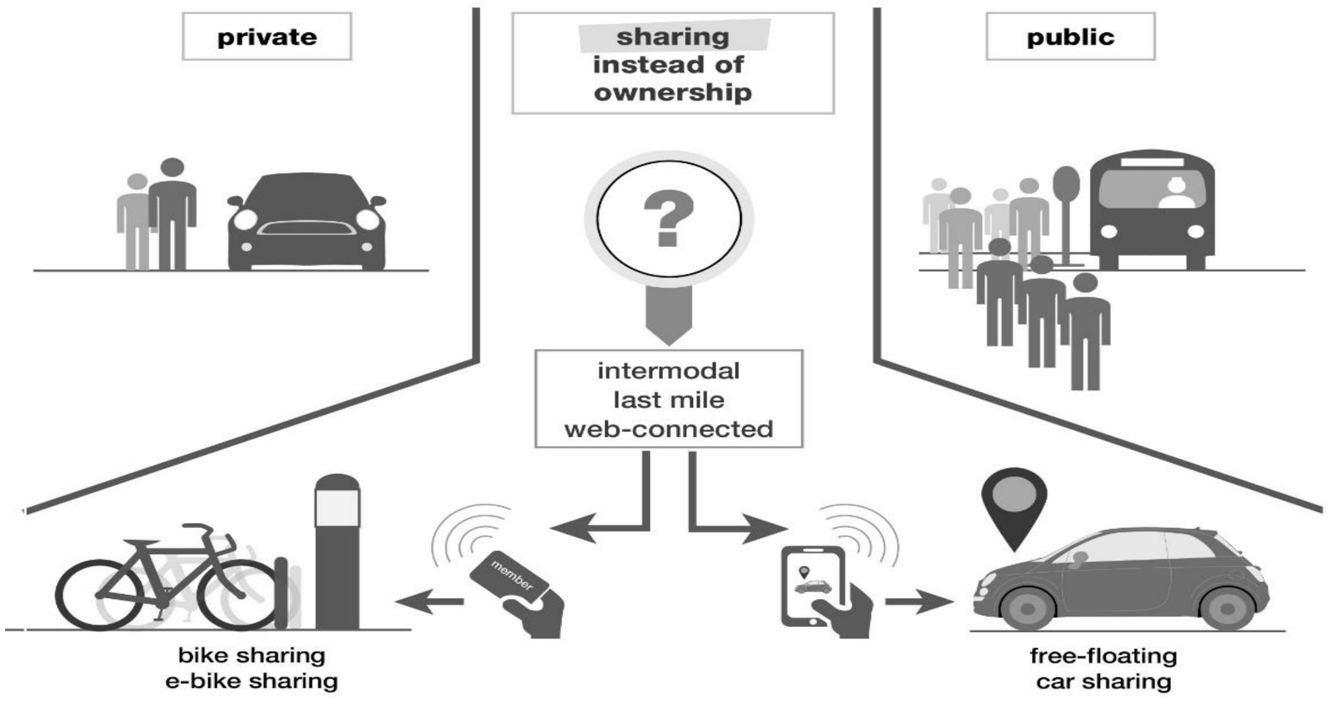
Urban Vehicle Access Rules (UVARs):
new generation of UVARs that are now starting to be seen.
They include kerb side management; dynamic space/price management; ultra-Low-emission Zones and Zero-emission Zones;
and hybrid schemes that combine measures such as congestion charges with emission
requhttps://www.eltis.org/sites/default/files/uvar_brochure_2019-09-26_digital_version_v2.pdfirements

Polis (August 2019) SUMP guide: UVAR and SUMPs. Regulating vehicle access to cities as part of integrated mobility policies

UVAR scheme objectives:

- Urban air quality improvement
- congestion reduction
- urban landscape preservation/retaining the traditional visual character of a place (historic town centres)
- climate change mitigation
- Quality of life and attractiveness
- Noise mitigation
- Road safety
- Redistribution of road space
- Raising revenues
- ...

Sustainable alternatives for Sustainable alternatives for the so-called ‘last mile mobility’ of daily intermodal commutes will provide as a suite of options, including personal mobility devices and micro-electric vehicles.
the so-called ‘last mile mobility’ of daily intermodal commutes will provide as a suite of options, including personal mobility devices and micro-electric vehicles.



Polis & EPA *Working Paper on Parking and Urban Development* (November 2019)

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' We need to talk about parking policy, not [JUST] about technology.'

Polis – EPA parking working group

- two papers were published describing the current and (potential) future state of play of digital applications for local parking management.
- This included recommendations on how to **optimize the use of digital parking tools in urban mobility policies**.
- The 2018 Polis parking paper concludes that '**Polis members, local governments managing parking, see digitalisation of parking in a wider context**.
- For them, it is about **reaching wider mobility and transport policy goals – embedded in a global spatial, economic and social vision for the city**.'

Park4SUMP:

"Once the findings and recommendations from the on-going Horizon 2020 follow-up project Park4SUMP (2018-2022) are delivered, this **Practitioner's Brief will be further developed into a 'Topic Guide' on how to integrate parking management into SUMPs**.

This will be based on all the work in Park4SUMP: research in 14 EU countries and the experience of 16 partner cities in introducing/adapting parking policies in their **new and improved SUMPs with the help of a new tool, PARKPAD**, and in implementing the best practice and innovative parking solutions."

[EU Push & Pull project] Park4Sump (June 2019): SUMP Practitioner Briefing: *Parking and Sustainable Urban Mobility. How to make parking policies more strategic, effective and sustainable*.

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- **Parking controls and pricing** are often perceived to be a 'rip off' measure, causing resistance to and distrust of the organising authorities … parking management has caused many political and public controversies.
- **Parking management** has often remained a domain untouched by decision makers, unless parking problems have spiralled out of control and/or the city wants to gain financial revenue.
- This has led to a **merely reactive and operational way of dealing with parking**, mainly only responding when a specific problem pops up (at a certain location), and/or using an isolated approach, further facilitating car use.
- Thus a **predict and provide mechanism – often focusing on infrastructure** – has dominated parking policy in many cities for many years.

- The **Norwegian** parking regulations require EV charging facilities on parking spaces where the public is offered parking on conditions, for example for payment of a fee or time limit (The Norwegian Public Roads Administration - from July 2018)
- Regulation on the requirements for EVSE in new buildings and parking lots (Norwegian Ministry of Transport, 2016).
- For parking lots and parking areas of new buildings, a minimum amount of 6% has to be allocated to electric cars.

SUMP Topic Guide: *Electrification. Planning for electric road transport in the SUMP context* (Sep. 2019)

https://www.eltis.org/sites/default/files/electrification_planning_for_electric_road_transport_in_the_sump_context.pdf

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- The Topic Guide focuses exclusively on the electrification of road transport, understood as the use of battery electric vehicles and hybrid vehicles.
- It is not intended to be a technical guide to the deployment of Alternative Fuels Infrastructure (AFI). Rather, its aim it to guide mobility planning authorities in the process of how the electrification of road transport can be carried out in accordance with the eight main SUMP principles following the different steps of the SUMP cycle.
- Post-Paris agreement: The EU intends to decrease its emissions by 20% by 2020, by 40% by 2030 compared to the emission levels of 1990 and calls for a carbon-neutral Europe by 2050. transport sector is also responsible for the emissions of greenhouse gases which contribute to climate change. In 2016, the transport sector accounted for 27% of the total greenhouse gas emissions in the EU. Road transport accounts for 72% of the greenhouse gas emissions of the whole transport sector. Furthermore, transport is the only sector which has not seen a decline in its CO_2 emissions, compared to 1990. According to the EEA, the emissions of greenhouse gases of the transport sector in the EU have increased by 28% between 1990 and 2017. Given its contribution to the total emissions of greenhouse gases, transport is one of the key sectors which must take action and decrease its emissions.
- Air pollution issues, in particular, the emission of fine particles which are less than or equal to 2.5 microns in diameter, also known as $PM_{2.5}$, have a particularly negative impact on human health … emissions of $PM_{2.5}$, together with the emissions of NO_2 and O_3.
- (Urban) road noise pollution.
- Although e-mobility is a cross-cutting topic, covering public transport, urban freight, shared mobility, private mobility, micro-mobility and even active mobility (e.g. electric bicycles or scooters), integrating e-mobility in a sustainable urban mobility planning strategy does not equate to ‘simply’ replacing diesel and petrol vehicles with their electric counterparts.
- A number of issues and specificities must be tackled, including the provision of charging infrastructure, the cooperation with a wide range of stakeholders, the procurement of new fleets by public authorities and transport operators, adapted parking regulations and the management of regulations and privileges for EV users.
- The market of EVs is expected to increase rapidly in the coming years, starting from 2020 when many car manufacturers will introduce new EV models on the market. To accelerate this process, the EU regulation 2019/631 introduces an incentive mechanism for the production of zero- and low-emission vehicles (ZLEVs are vehicles emitting less than 50g of CO_2 per km). This regulation sets an objective for every manufacturer to sell at least 15% of ZLEVs (cars and vans) yearly.
- The recently revised EU Clean Vehicles Directive sets minimum procurement targets for each category of vehicle and for each Member State.

Relevant questions for planners – and some varied city answers

Plan for sustainable mobility in the ‘functional city’ – different scales in scope: commuting to blocks and cells

• How do **institutional and governance structures in local authorities** reflect the need to plan for e-mobility and electric charging infrastructure?

• At which **institutional level(s)** does **e-mobility need to be addressed in order to effectively respond to the urban mobility challenges?**

SUTP (**Sustainable Urban Transport Plan**), SUMP (**Sustainable Urban Mobility Plans**) and SULP (**Sustainable Urban Logistics Plans**) – see: Fossheim, K. and Andersen, J. (2017) Plan for sustainable urban logistics – comparing between Scandinavian and UK, *European Transport Research Review*, Vol. 9: 52.

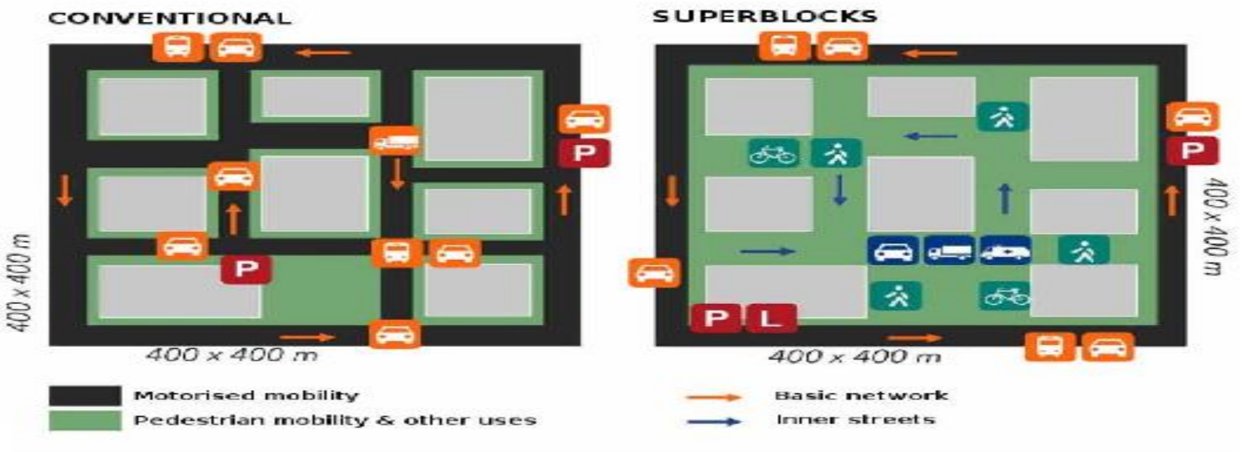
Birmingham City Council: new Draft Transport Plan for 2031 – traffic cells, no personal motorised traffic through city centre‘

https://www.birmingham.gov.uk/info/20013/roads_tra _birmingham_transport_plan

Sub-urban: ECCENTRIC (CIVITAS)
https://civitas.eu/sites/default/files/eccentric_1st_brochure_final_draft_b.pdf

Sustainable Urban Mobility and Public Space Plan (SUMPSP)

- **Superblocks concept**:
- Vitoria-Gasteiz, BC, Spain), and Barcelona etc.



GreenCharge will develop technical solutions and business models that encourage e-mobility, based as as far as possible on renewable energy. It will carry out trials at sites in Barcelona, Bremen and Oslo & evaluate impact.

Relevant questions for planners – answers?

- How does the introduction of e-mobility align with different institutional goals and a city's vision?
- What are the first steps to take to set the ground for the introduction of e-mobility?

Bremen (Germany):

Several EU projects.

E-mobility strategy (incl. car sharing, e-bikes, logistics, and public transport) and

Green Masterplan (2018, with German Federal funding, and citizen and stakeholder consultations), which includes Wind, PV, urban hydropower and autonomous driving / shared autonomous EVs.

- How to plan for innovation?

Umeå (Sweden)

– testing renewable charging hub;

- Developing a new business model for energy efficient city land use, aiming at the reduction of demand for car parking spaces and directing developer investments away from parking towards sustainable mobility solutions (car sharing, e-buses, cycling etc).
- Energy-optimized Bus Rapid Transit stop/station.

Relevant questions for planners – answers?

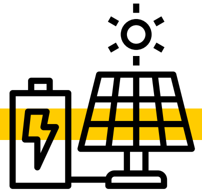
Interreg
North Sea Region
SEEV4-City
European Regional Development Fund
EUROPEAN UNION

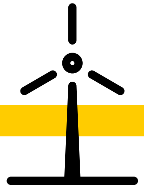
Gdynia (Poland): SUMP - and ambition to combine PV and electric trolleybus depot, and perhaps wind), and Low Carbon Economy Plan

€

Glasgow (Scotland, UK): store surplus electricity from the neighbouring TCB energy centre, and how this impacts energy generation priorities and load profiles.

This will inform a business model which considers how energy resale from batteries to other local organisations could be achieved within the regulatory framework.





Rotterdam (Netherlands):

“We allow other fuels, but the only field we will support is zero-emission.“ Towards zero-emission mobility (49% CO2 reduction fron 1990). V2G smart-charging parking spots.

Gronigen & Drenthe: e-mobility, yes, but ideally towards hydrogen (fuel cells), in combination with wind (or solar) and batteries. And also autonomous buses.

Aberdeen (Scotland, UK): mixed strategy on this also, expanding field cell hydrogen (buses).

Planning concepts developed by SEEV4-City cities / boroughs

https://www.seev4-city.eu/wp-content/uploads/2020/09/SEEV4-City-Policy-Recommendations-and-Roadmap-1.pdf

SEEV4-City report provides short overview of evidence found for SUMEP/s at the six cities or towns where SEEV4-City Operational Pilots are located. These are:

- Amsterdam (the Netherlands);
- Kortrijk (Flanders, Belgium);
- Leicester (England, United Kingdom);
- Loughborough Charnwood Borough) / Burton-upon-Trent (part of East Staffordshire Borough (England, United Kingdom);
- Oslo (Norway).

There is no single SUMP, as defined by the European Commission available on the above municipalities' websites.

Note that the challenges for large metropolitan regions, such as the one surrounding Oslo and Amsterdam, present additional coordination issues for SUMP/s, as detailed in the recent SUMP topic guide "Sustainable Urban Mobility Planning in Metropolitan Regions".

- Given the challenge of developing and implementing SUMPs, and the concept of a Sustainable Urban Mobility and Energy Plan (SUMEP) being new, it is no surprise that none of the SEEV4-City partner cities has a SUMEP in place.
- However, it is not necessary for a city to have named their plans as SUMP or SUMEP – it suffices that concrete actions have been undertaken. Using this as a definition, all five cities have a mobility strategy and/or a SEAP or similar, and possibly even SUMEP in place.
- Nevertheless, there is marked difference in the sophistication exhibited by the planning strategies and other instruments from the different cities, which roughly correlates to the publicly stated degree of (climate) ambition in the city plans to 2025, 2030 or 2050.

Motivations and opportunities

National, regional and local statistics indicate that the transportation use of individualised road transport vehicles is only about 20% of the time typically even on working days, hardly during the late evening and night, and even less so on weekends.

Even many commercial and logistics vehicles have significant downtimes from transportation use, especially overnight and on Sundays.

Adapted from Wilde and Klinger (2017, p. 7)

Transport	Mobility
Movement	Motility – the ability to actively move, socially and spatially
Physical	Physical – socially – cultural
Distances and paths as central measurement units	Activities and accessibility as central measurement units
Rather aggregated	Rather individualised
Often construction, infrastructural and planning problem formations/framings	Rather social and psychological problem formations/framings

Translated & adapted from Ernst et al, 2013, p. 354

Environment	Transport/Mobility	Economy	Image
Reduction of emissions and pollution (harmful gases, substances, participle)	Electro-mobility as a building block of systemic transport concepts	Support for new markets and technologies	The city as a fore-/front-runner
Resource-efficient solutions	Mobility increasingly thought as decoupled from a vehicle	Raising the attractiveness as an economic location	Competition between cities to attract both residents and companies

Conclusions

- **The Transport Mode Hierarchy should be followed**; i.e. active travel to be prioritised first (walking and cycling), then pubic transport (trams, buses etc.), then shared transport in road vehicles (travel-to-work plans, car sharing, and then individualised vehicles (including taxis and minicabs) with a focus on ultra-low carbon ones (which can be fuelled by a number of means, including by electricity). Similar principles would apply for freight and urban logistics transport.
- In practice, there may be an **identifiable trend in cities for now of electric vehicles being an additional household vehicle, with thus currently at best only a part-substitution of ICEs**.
- Whilst the **central or local grid stakeholders** may still be at times cautious about **the stress electric vehicles in large numbers may place on the grid, potentially requiring grid reinforcements**, they also now begin to see the **value of Vehicle-for-Energy Services (V4ES) where electric vehicles – when not in transportation use mode – can balance the grid**.
- Electric vehicles (such as cars and vans, as well as e-bikes in SEEV4-City, and buses also in other projects) need **integration into the local and central electricity grid, and with renewable energy**.
- Electric vehicles (full battery EVs as well as those hybrid ones with large EV batteries) as well as stationary batteries, can **store electricity from the grid at times of oversupply in them, especially from intermittent renewable energy sources.**
- **At peak demand for electricity in the grid electric vehicles can supply electricity to the grid (Vehicle-to-Grid).**

These **electric Vehicle-for-Energy Services (eV4ES) may need an aggregator, as well as ICT and software support functions, which opens up commercial opportunities for energy services companies**, though there needs to be a sufficient net revenue for electric vehicle owners to compensate them (beyond the supplier/ manufacturer's warranties) for electric vehicle battery degradation and inconveniences).

Furthermore, **electric vehicles – when not in transportation use mode – can provide smart energy management functions as part of a V2B set-up, leading to greater efficiency of use of self-produced renewable energy (solar in particular, but also micro-wind etc.) as well as emergency backup power**. A combination with a stationary battery may make sense, depending on the circumstances. This battery can also then provide grid services.

https://www.seev4-city.eu/wp-content/uploads/2020/09/SEEV4-City-Project-Policy-Recommendations.pdf

- Merging SUEP and SUMP into an integrated systematic approach: SUMEP Sustainable Energy Action Plan(ning) (SEAP) and Sustainable Energy Climate Action Plan(ning) (SECAP) as well as Sustainable Urban Mobility Plan(ning) (SUMP), including guidance/processes, can in themselves be characterised as separate policy-packages.
- Integrating these packages will bring benefits regarding decarbonisation of energy production, distribution, supply, and consumption as well as energy storage to achieve (ultra-) low carbon Sustainable Urban Mobility and Energy Planning (SUMEP).
- The integration needs to be made in the context of increasing electrification of energy infrastructure and transport together with the local and central electricity grid, as part of the move towards a “Smart Grid”. The Smart Grid approach also entails an increase in distributed energy sources (usually renewables), distributed battery energy storage and ‘prosumer’ concept (who both produce and consume electricity). These need to be considered and integrated in the context of electric Vehicle-for-Energy-Services (eV4ES).
- To achieve significant decarbonisation of the transport sector, the electricity grid, energy infrastructure, electricity generation, transmission and distribution need to become much less dependent on fossil fuels. Better integration of renewable energy (i.e. solar, wind, hydro) needs to be advanced and supported. The cost of production (and use) of renewable energy is declining and is becoming competitive with fossil fuel energy generation. Energy autonomy may, on occasion, further reduce the cost of energy, if based on locally (self) produced renewable energy, including for use in charging electric vehicles
- The SEAP and SECAP Covenant of Mayors guidelines and planning processes focus on the key assets of buildings, equipment and facilities (municipal and third party owned) as well as transport; the SUMP guidelines focus on ‘functional’ municipalities. Thus, there should be, in principle, no conflict in terms of the overall objectives beyond the administrative boundaries for the SUMP guidelines. This is because of the way the traffic flows of both people and goods (including commercial) occur, which needs to be addressed regarding economic, technical, environmental and social sustainability.

Thank You !

Questions ?

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